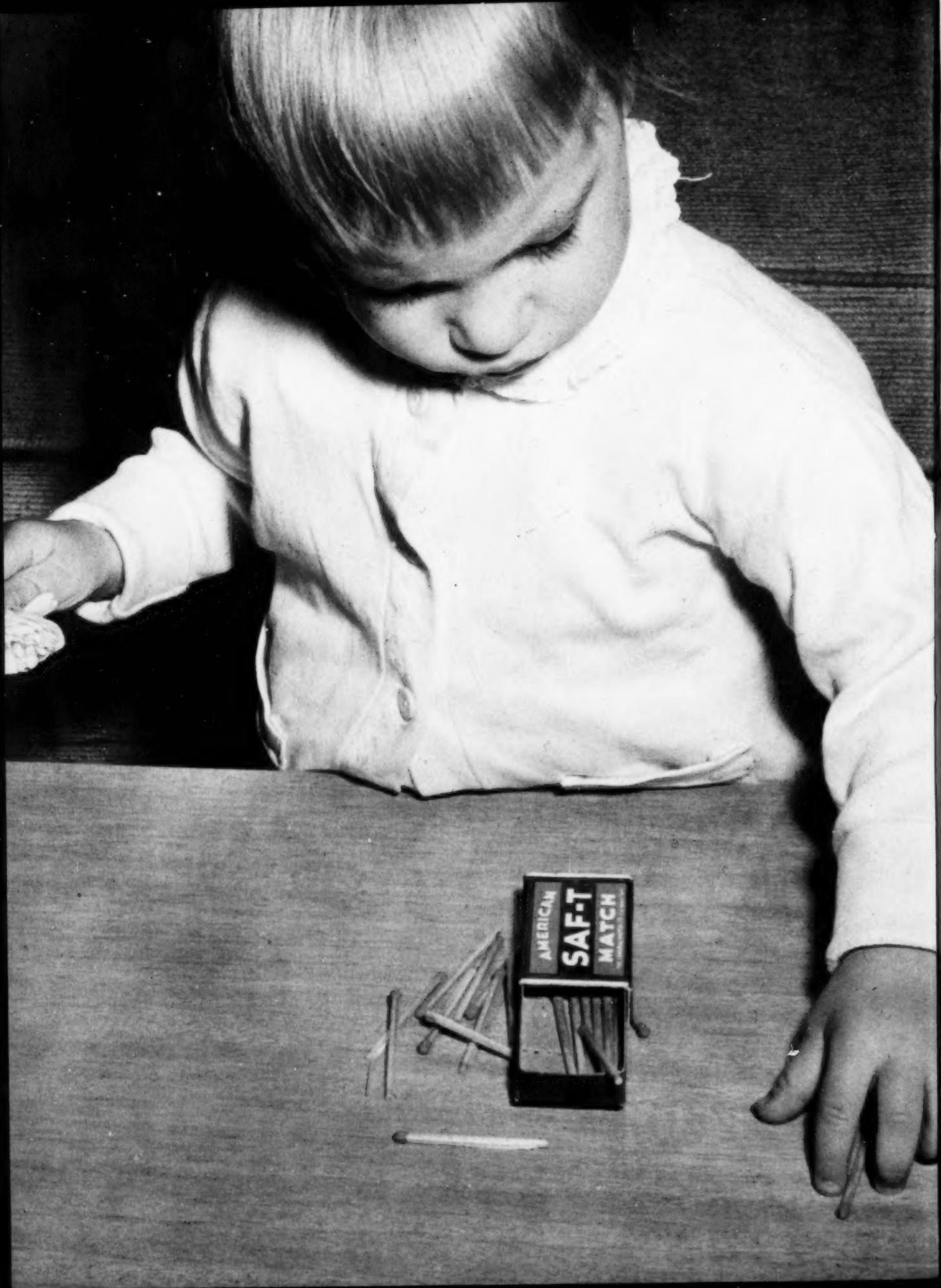


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In this issue



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Prevention of home accidents strikes at a common killer of children. The little girl playing with matches, photographed by Dr. Charles M. Cameron, Jr., illustrates one type of hazard. A leaflet on accidental poisoning is described on pages 450-452.



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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Cardiovascular Disease Programs for the Community

By WILLIAM J. ZUKEL, M.D., HERMAN E. HILLEBOE, M.D., and JOSEPH T. DOYLE, M.D.

THE COMMUNITY expects leadership from the health officer in solving its major health problems; these may be infectious diseases in one area or chronic diseases in another, or both in many areas. The growing problem of cardiovascular disease, which is now responsible for more deaths in the United States than all other diseases combined, should challenge the best efforts of every health officer to seek counter measures. In New York State during 1954, for instance, cardiovascular disease was given as the cause of more than half of all deaths (see table).

Ultimate death, of course, cannot be avoided, but premature death, unnecessary suffering, and disability can often be prevented. The First National Conference on Cardiovascular Diseases (*1a*) in 1950 brought out the need to apply existing knowledge of cardiovascular disease control; at the same time, it was recognized that continued research is of prime importance. Much is yet to be learned about effective measures for controlling cardiovascular disease; however, the considerable experience and new

knowledge that have accumulated indicate promising tangible activities.

More than 50 diseases are known to produce myocarditis as a major or associated complicating illness (*2,3*). These include rheumatic fever, diphtheria, rickettsial disease, syphilis, tuberculosis, meningococcemia, leptospirosis, trichiniasis, tularemia, and brucellosis. Most of these diseases have been responding well to public health measures. Rheumatic fever, too, could be removed from its place as third most common cause of heart disease by the concerted effort of private and public health physicians. Effective use of present knowledge of prevention and the early treatment of streptococcal infections could make the disease a rarity.

Atherosclerosis and hypertension remain the greatest heart problems. But even with these, there is reason for optimism that research efforts will provide at least partial measures for control in the foreseeable future.

Since the scope of the cardiovascular disease problem is so broad, every health officer can find some area for positive action. How much is accomplished may depend more on the interest and activity he can stimulate within the local medical profession and in the community than on the size of his staff or budget. Physicians will support services that benefit the patient, if these services do not infringe on physician-patient relationships. By working with the physicians, the local heart association, community leaders, and representatives of community agencies, a thoughtful appraisal can be made of community needs and a program developed to meet these needs. Although measures to meet specific needs in cardiovascular

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disease are in themselves important, they should relate as well to other chronic diseases in the community.

Although no two communities are identical, there are several activities applicable in most communities. Some involve action on present knowledge; others would entail studies to add to our information (see outline). A review of some of these activities follows.

Primary Prevention

Specific measures directed toward the prevention of infectious diseases, such as diphtheria, syphilis, and tuberculosis, should be applied at every opportunity. The drama of preventive measures may not match that of surgical correction of congenital anomalies, but the value of prevention is unquestionable and lasting. There are sound recommendations for the primary prevention of cardiovascular disease in the reports of the First National Conference on Cardiovascular Diseases (1b) and of the Chronic Illness Commission (4). Certain aspects are worthy of review here.

Congenital Heart Disease

Congenital heart disease is far from being a rare condition. Richards and associates (5) in a careful study of an unselected series of 6,053 births found 50 cases of congenital cardiovascular malformations, an incidence of 0.83 percent. Twenty-nine of the fifty cases survived 1 year, representing 0.5 percent of the total study group surviving that long. In some school surveys, congenital heart disease has been as prevalent as rheumatic heart disease (6, 7).

Of recognized public health importance is the relationship of maternal rubella infections during the first trimester of pregnancy to the development of anomalies in the fetus (8). The estimates of 100 percent risk (9) of anomalies from rubella occurring during the first 2 months of pregnancy appear to be too high, and a figure closer to 20 percent (10) is a more realistic estimate from prospective studies. Nevertheless, the gravity of the consequences has been considered by some to be justifiable reason for therapeutic abortion in women who contract rubella during the first 3 months of pregnancy (1b, 11).

Program Activities for Cardiovascular Disease

Prevention: primary and secondary

Community research

Education and information

Detection programs

Diagnostic services

Ancillary services: nursing, nutrition, medical social, physical therapy, vocational guidance, laboratory

Nursing homes, convalescent homes, home care

Rehabilitation

Evaluation

The American Public Health Association (12) and the Committee on Immunization and Therapeutic Procedures for Acute Infectious Diseases of the American Academy of Pediatrics (13) are in agreement on basic recommendations regarding rubella and birth anomalies. Essentially they are: Girls in good health should not be protected from exposure to rubella before puberty since permanent immunity usually follows the disease. Women in the first 4 months of pregnancy should avoid exposure to rubella if possible. Gamma globulin should be administered to women who are exposed to rubella during the first 4 months of pregnancy to provide the possible protection afforded by the induced passive immunity.

The dosage of gamma globulin presently recommended by the New York State Department of Health for intramuscular administration is from 0.2 cc. per pound of body weight to a maximum dose of 20 cc., preferably containing material from two different lots (14). This is based on the finding that the titer of rubella antibodies may vary with different lots of pooled gamma globulin (15) and that the higher dosage should be more effective in preventing rubella.

Other viral diseases during the first trimester of pregnancy have been incriminated as causing fetal anomalies, but the relationship is not yet established. Herpes simplex during the first trimester had a suggestive but perhaps coincidental relationship to the development of the tetrad of Fallot in Richards' study (5). Mumps, measles, varicella, poliomyelitis, infec-

tious mononucleosis, influenza, herpes zoster, and virus pneumonia during the first trimester of pregnancy are mentioned as reported causes of fetal anomalies in collected cases of Kaye and associates (16). Dietary deficiencies in the mother during early pregnancy suggest an association with a higher incidence of fetal anomalies, but the relationship is difficult to prove (17). Prospective studies will be needed to establish the validity of these observations.

Experimental animal studies and accumulated clinical evidence reveal that congenital anomalies in the embryo and fetus can result from extensive pelvic irradiation (18-20). Current practice usually recognizes this potential danger and elective, prolonged X-ray studies are avoided during pregnancy. Russell and Russell (19) concluded from animal studies that roentgen dosages well within the range used in diagnostic fluoroscopy might cause subtle alterations in the fetus if exposure occurred at a critical time. They recommend that irradiation of the uterus in women of child-bearing age be restricted to the 2 weeks following the last menstrual cycle to preclude the possibility of irradiation after fertilization has taken place.

Even with its limitations, our current knowledge gives encouragement that other factors might be revealed as causative agents in congenital heart disease. The epidemiological approach toward determining such possible factors is a sound one.

Rheumatic Fever

Present knowledge indicates that rheumatic fever has become a preventable disease. Several studies have shown that first attacks of rheumatic fever can be prevented when the initiating streptococcal infection is diagnosed and promptly treated with penicillin (21-23). For acute streptococcal infections, a single injection of 600,000 units of long-acting benzathine penicillin G is effective. Among 1,175 children with streptococcal infections treated with this regimen by Breese and Disney (23), no clinical rheumatic fever or acute glomerulonephritis was noted in the entire series. An attack rate of clinical rheumatic fever of perhaps 3 to 5 percent might have been expected without such treatment (24, 25). Any other dosage regimen

of penicillin is acceptable if it maintains bactericidal levels of the drug in the individual over a period of at least 8 to 10 days (26). Treatment of acute streptococcal infections with sulfadiazine has not been effective in preventing subsequent rheumatic fever (27). Sulfonamides are, however, of value as a daily prophylactic measure for known rheumatics in preventing streptococcal infections that might result in recurrence of rheumatic fever (26, 27).

A youngster who has a history of rheumatic fever may have as high as a 50 percent chance of developing a recurrence of rheumatic fever if he develops a new streptococcal infection (28). It appears that it would be advisable for persons with a history of rheumatic fever to be placed on a continuous prophylactic regimen for a period of at least 5 years from the last attack. In a report by Bland and Jones (29) on 1,000 patients with rheumatic fever and rheumatic heart disease followed for 20 years, the recurrence rate in the preprophylaxis era was approximately 1 in 5 per year during the first 5 years, 1 in 10 per year during the next 5 years, 1 in 20 during the third 5-year

Deaths and death rates per 100,000 population, New York State, 1954

Cause	Number	Rate
All causes-----	159, 540	1011. 7
Cardiovascular diseases-----	89, 275	566. 1
Vascular lesions affecting the central nervous system-----	14, 036	89. 0
Diseases of the heart-----	70, 615	447. 8
Chronic rheumatic heart disease and rheumatic fever-----	2, 472	15. 7
Arteriosclerotic heart disease including coronary disease-----	53, 186	337. 3
Nonrheumatic chronic endocarditis and other myocardial degeneration-----	6, 479	41. 1
Hypertension with heart disease-----	7, 932	50. 3
Other diseases of the heart-----	546	3. 5
Hypertension without mention of heart disease-----	996	6. 3
General arteriosclerosis-----	2, 740	17. 4
Other diseases of circulatory system-----	888	5. 6
Tuberculosis-----	1, 829	11. 6
Malignant neoplasms-----	29, 392	186. 4
Accidents-----	6, 503	41. 2
Poliomyelitis-----	99	. 6
All other causes-----	32, 442	205. 7

From Supplement to Monthly Vital Statistics Review, April 1955, New York State Department of Health.

interval, and 1 in 70 in the last 5-year interval. Acceptable methods of prophylaxis are oral sulfadiazine, 0.5 to 1.0 gram daily, or daily oral penicillin of 200,000 to 400,000 units, or a monthly intramuscular injection of 1.2 million units of benzathine penicillin G. Specific recommendations for dosage have been formulated by the Council on Rheumatic Fever and Congenital Heart Disease of the American Heart Association (26). They form a sound medical basis for a community program for the prevention of rheumatic fever.

A practical problem in such community programs has been to maintain faithful adherence to the long-term schedule of prophylaxis. The health department is uniquely able to help the physician with this problem by providing a followup service, especially through public health nurses. In some communities the health department serves as the focal point for distributing the drugs ordered by physicians (30). A roster of patients can be kept, the regularity of refill of prescriptions can be noted, and lapses from treatment more readily detected and prevented. Other communities have found that the school can serve as a focal point for carrying out the physician's prescribed regimen. This has worked successfully in Cortland County, N. Y., where such a program has operated for the past 5 years. Success in preventing rheumatic fever will depend on the faithfulness with which long-term services are maintained. Recurrences of rheumatic fever should be reduced by at least 85 percent if an adequate regimen of sulfa or penicillin prophylaxis is followed (21, 31).

Subacute Bacterial Endocarditis

A serious complication of congenital, rheumatic, or other valvular heart disease is subacute bacterial endocarditis. This disease carried a fatality rate of almost 100 percent before the use of antibiotics. Now a cure rate of approximately 75 percent is possible with proper treatment (32), but irreparable damage to the heart valves proceeds unless the invading organisms are destroyed. This disease is almost certainly preventable when prophylactic doses of antibiotics are given to persons with congenital, rheumatic, or other valvular heart disease prior to and during any operative pro-

cedure that might produce bacteremia. Common surgical procedures which may result in subacute bacterial endocarditis in persons with valvular or congenital heart disease include dental extractions; surgery about the mouth, nose, and throat; genitourinary operations; and obstetrical deliveries. Published recommendations of the Council on Rheumatic Fever and Congenital Heart Disease are good guides to follow (26). The routine application of this knowledge by physicians and dentists pays full dividends. The methods of accomplishing this can be worked out with professional groups in the community.

Coronary Artery Disease

Coronary artery or atherosclerotic heart disease cannot be prevented as yet; however, there is evidence that it is not an unalterable process (33, 34). Katz (35) has reported that early lesions of experimental atherosclerosis in the chick and in the rat can be reversed by estrogen therapy. Stare and his co-workers (36) are currently studying whether dietary alterations will reverse experimental atherosclerosis induced in Cebus monkeys.

Keys and his co-workers (37) have contributed additional knowledge that lends encouragement for the future understanding of the mechanisms of atherosclerosis. Population groups such as our own, with an average diet containing 40 percent of the calories as fats, are said to have more coronary artery disease than do population groups such as the Japanese and Bantus whose diets contain less than 20 percent of caloric intake as fat (38). Women before the menopause have appreciably less atherosclerosis (39) than do men even though they presumably have much the same diet.

As yet the data relating to diet and atherosclerosis are not conclusive enough to warrant a specific program for attempting to change diet patterns of the general public. However, for individual patients with coronary artery disease, physicians are increasingly tending to prescribe diets low in total calories and relatively low in animal fat content. The usual range of cholesterol intake in humans apparently does not affect appreciably the serum cholesterol level (40, 41). Animal fat, such as lard, produces a significant rise in human serum

cholesterol whereas corn oil substituted at the same caloric level results in a fall in serum cholesterol (42). The differing effects on serum cholesterol of animal fats and vegetable fats are being studied further (42, 43).

Physicians are finding that good nutrition services in the community are becoming as much of a need as are adequate dietary services within the hospital. Health departments can provide such services in the community through nutritionists and public health nurses trained in diet interpretation.

Hypertension

The etiology of hypertension is still unknown although many factors have been implicated in a complex interrelationship of possible causes. Some of these are the sodium ion, adrenal and pituitary hormones, neurogenic factors, and renal pressor mechanisms involving renin and other pressor factors (44, 45). Observations have been made of a frequent association of obesity and hypertension (46). While no causal relationship is claimed, it is accepted clinical practice to advise weight reduction for obese hypertensive patients (45). A favorable effect of such weight reduction on the elevated blood pressure has been demonstrated, and this is not an artifact induced by change of girth of the arm (47). Obese individuals with labile high blood pressure have a greater probability of later developing persistent hypertension than do persons who are not overweight (48).

It seems that obesity control should be part of the basic teaching of good nutrition habits early in life and profitably could begin in the elementary schools. Considerable experience has accumulated on techniques for weight reduction of obese individuals, but maintaining the achieved reduced weight level is probably the most difficult prescription to follow in all medical practice (49, 50). The physician interested in nutritional guidance for obesity control can obtain nutrition consultation services through his State and local departments of health.

Secondary Prevention

Cardiovascular diseases will likely be with us for some time to come, so we should learn

to live with them with a minimum of discomfort and disability. The continuing counsel, supervision, or treatment by a well-informed physician is the only measure known for delaying the course of the disease and preventing unnecessary complications. Both emotional and physical disability can be prevented or postponed in many ways.

Attitudes of employers, of family members, and of close associates influence the reactions of the person with heart disease toward his condition. Thus, members of the community can help reflect the increasing optimism of the medical outlook for cardiovascular disease. Fortunately, publicity and educational information regarding heart disease have, in general, avoided the fear approach; this is a sound policy to continue.

The prevention of recurrences of rheumatic fever has already been discussed. Measures for preventing the progression of congestive heart failure and for preventing sequelae of cerebral vascular disease are other community services that will aid physicians and patients alike. The common complications and disability from peripheral vascular disease also present a challenge, but present knowledge of preventive measures is limited. Rehabilitation is especially indicated for these conditions.

Congestive Heart Failure

A cursory survey of the cardiac patients in any general hospital will reveal some who are repeated visitors because of recurrent episodes of congestive heart failure. Gold (51a) found that 20 percent of congestive failure patients in a hospital had multiple admissions for the same reason. These are not as a rule the intractable patients about whom much is written but who comprise only a fraction of this group. Most of these patients have merely lapsed from an initially adequate regimen of digitalis, sodium restriction, and diuretics. Since the symptoms of congestive failure are insidious in development, the patient may be gradually accumulating edema without distress over a period of weeks before the acute episode of failure suddenly develops. This type of progression can ordinarily be prevented.

A patient who has recovered from one epi-

sode of cardiac failure can often be maintained in compensation for several years on a suitable regimen of digitalis, sodium restriction, mercurials as needed, and moderate physical activities (52). The routine is less complicated than that required for regulating a diabetic on diet and insulin. Diabetic coma is regarded as an unforgivable lapse of medical management, while acute congestive failure is shrugged off as inevitable in an "uncooperative" patient. Leiter (51b) found that one of the main reasons for poor results even in the hands of experienced physicians was incorrect diet. The physician who takes the time to educate his patient has little difficulty in maintaining the patient free of decompensation. The intricacies of the low sodium diet require that the patient learn to select foods and beverages of low sodium content and to avoid products containing sodium such as seltzer tonics and most laxatives.

Special classes (53) by dietitians, nutritionists, or public health nurses have been organized to give patients practical information regarding the low sodium diet. Patients referred to such classes by their physicians have benefited both in the exchange of information on ways to make the diet appetizing and also in the mutual feeling of support which comes from knowing that others face the same problems.

Public health nurses already are giving mercurials or diet instruction on request of physicians to a number of congestive heart failure patients who are homebound. This type of service could well be extended. Since more than half (54) of the individuals with organic heart disease may develop congestive heart failure, a program that assures optimum long-term treatment would return dividends in economic savings and in the prevention of unnecessary disability.

Cerebral Vascular Lesions

It is estimated that more than 1.8 million persons in the United States are disabled by cerebral vascular lesions (55). The majority of these are elderly individuals who have suffered a cerebral thrombosis with resulting hemiplegia. A small proportion of the disabilities are the result of cerebral embolism following rheumatic heart disease with auricular fibrillation, or of an embolus developing from a mural

thrombus after a myocardial infarction. Other uncommon disorders may also result in hemiplegia. Very few persons with intracerebral hemorrhage survive; therefore, thrombosis or embolism is usually the underlying factor in surviving hemiplegics.

Long-term anticoagulant therapy has been effective in reducing recurrences of thromboembolism in rheumatic heart disease with auricular fibrillation and a history of previous embolism (56). Studies of the use of long-term anticoagulant therapy for persons who have had cerebral thrombosis are in progress, and there is some indication that basilar artery thrombosis may be prevented by anticoagulants when administered during early stages of basilar artery insufficiency (57). Adequate laboratory facilities must be available in the community to provide reliable prothrombin determinations for physicians who wish to use the effective but potentially dangerous drugs such as dicumarol, tromexan, or similar anticoagulants.

The prevention of unnecessary disability in hemiplegics is a complex problem that requires many community health services. These patients may live for several years with alert minds trapped in dysfunctioning bodies. The speech handicaps of aphasics are particularly difficult since the patients may understand everything spoken to them but are unable to express their comprehension in words. Speech therapists are scarce in the average community. However, interested school teachers could use the instruction material (58, 59) that is available for teaching aphasics and contribute invaluable help in this aspect of the problem.

The physical therapist is the major contributor toward the physical reeducation of the hemiplegic. Destroyed function cannot be restored, but in many instances enough function remains in unaffected muscles to allow retraining for performance of basic activities. The psychiatrist should be called in soon after the onset of illness to outline the physical therapy required. Rehabilitation centers that are being developed in many States will help meet the needs of hemiplegic patients; however, most communities must depend on their own resources.

Peripheral Vascular Disease

The extent of disability and economic loss from peripheral vascular disease is not known, but estimates indicate it is considerable. Long-suffering patients with gangrene of the toes or indolent ulcers are commonly seen in hospital wards. Too often a series of amputations of increasingly serious magnitude follow in rapid succession. Arteriosclerotic peripheral vascular disease, varicose veins, thrombophlebitis, phlebothrombosis, thromboangiitis obliterans, Raynaud's disease, frostbite, and immersion foot are some of the more common of the peripheral vascular disease problems.

Early recognition of the disease and medical supervision are important in preventing complications in these patients. Meticulous regulation of diabetes is of great importance as is avoidance of mechanical, thermal, or chemical trauma to the extremities (60). Prevention and adequate treatment of bacterial and fungal infections, regular foot hygiene, and abstinence from smoking are other measures of general value. Instruction of diabetics in daily foot care is becoming more effective as physicians realize the importance of preventive measures. Public health nurses are also contributing further to this education through the increasing number of diabetic patients physicians are requesting them to see. The potential scope for such educational activities is seen from the fact that 20,300 public health nursing visits were made to diabetics in upstate New York during 1954 (61).

Educational materials on foot care used for diabetics should be equally useful for patients with other peripheral vascular diseases. The use of preventive measures of this type as found in standard texts (60) is a practical starting place in preventing the progression of disability from peripheral vascular disease.

Community Research

The research laboratory is traditionally expected to discover the etiology of diseases and develop appropriate therapeutic measures. However, it is well known that epidemiological studies provided knowledge for effective control of several important diseases long before the etiological factors were identified. In-

cluded are pellagra, endemic goiter, scurvy, dental caries, and retroental fibroplasia. Epidemiological studies have demonstrated the relationship of group A beta hemolytic streptococcal infections to the subsequent development of rheumatic fever (62); the same is true of the effect of rubella on congenital heart disease during the first trimester of pregnancy. Although epidemiological studies of coronary artery disease and of hypertension are now gaining more attention, further studies are needed to determine additional factors associated with their prevention.

Elaborate research studies are out of the question for many communities, but modest field studies are feasible in most communities, especially those with a good health department. Here are some examples of problems needing further study by community groups. It has been a clinical impression that farmers, lumberjacks, and manual laborers have less coronary artery disease than do city dwellers (63). It has been suggested in studies by Morris and associates (64) that occupational groups who perform heavy physical work have lesser amounts of severe coronary disease than do sedentary groups. Other factors incriminated without adequate confirmation are diets that are high in total calories or high in total fat (34) or cholesterol foods such as milk and eggs (65), cigarette smoking (66), and the stress of modern living (67).

Carefully designed studies are needed to test and confirm these theories, and such studies will have to be done at the community level. Industries with good medical departments can contribute valuable studies which attempt to relate occupational factors to coronary artery disease and hypertension. The work of Crain and associates (68) on the incidence and prognosis of myocardial infarction among employees lends optimism to the outlook for continued employability of persons who develop coronary artery disease. The economic loss to the community resulting from heart disease is of practical importance but has not been thoroughly studied. The incidence and prognosis of heart disease in the general population in different parts of the country are still unknown for both coronary and hypertensive vascular disease.

A comprehensive study of major factors related to coronary artery disease and hypertensive vascular disease is now in progress at the Cardiovascular Health Center (69, 70) in Albany, N. Y., but less elaborate studies in the community could give valuable information on some aspects of these problems. A health officer can interest private physicians in the many facets of the heart disease problem by developing a study that will provide new knowledge on the local heart disease problem. Many resources are available to help plan and carry out local studies. These include the universities, the State departments of health, the American Heart Association, and the Public Health Service.

Education and Information

The extent of knowledge about heart disease directly influences the effectiveness of community efforts directed toward the problem. This level of knowledge includes that of practicing physicians, nurses, social workers, vocational counselors, employers, and patients and their families. Professionals, nonprofessionals, and members of the general public are concerned with some aspects of the problem, even if it is merely from personal or family experiences.

The health officer should become involved in health educational activities to the full extent of his ability and resources. Postgraduate education for physicians is a specialized form of health education and is usually best carried on through the regular channels of the medical society, medical schools, and hospitals. The health officer and local heart association, however, can often bring in special speakers or teaching aids such as films, tape recordings, or other materials that are available and continually being developed by medical schools, the American Heart Association, the Public Health Service, and other organizations. The New York State Department of Health, like several other State health departments, maintains a library of health films that are available on loan to professional and nonprofessional groups.

Information on heart disease is essential for public health nurses, nutritionists, physical therapists, medical social workers, or any other

individuals who might be brought into heart program activities. The quality of service can be only as good as the caliber of personnel and level of their knowledge concerning their possible contributions to the problem.

The judicious use of educational information for the public can be helpful when specific program activities are being developed. It would be wise to have a medical advisory committee determine the general approach to be used in acquainting the public with health information since unsuitable materials may only stimulate fear of heart disease rather than constructive attitudes or action. People do not automatically accept health programs merely from the presentation of scientific evidence. Attitudes, beliefs, values, traditions, and many other factors influence their willingness to accept or undertake actions related to their health (71, 72). The health educator who understands the problems related to heart disease can be very helpful in developing program activities in the community. Through various processes of communication, medical knowledge can be transformed into public understanding and acceptance of specific health activities, for example, prevention of rheumatic fever, early detection of heart disease, and rehabilitation.

The local health department and local branch of the American Heart Association will do the best possible job of health education if they combine their resources in personnel and mass media and conduct a joint program of health education on a continuing basis.

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Change in Name of Institute

The National Microbiological Institute, one of the seven National Institutes of Health, Public Health Service, was redesignated the National Institute of Allergy and Infectious Diseases early in February 1956. Dr. Victor H. Haas is director of the institute.

The renaming of the institute reflects the importance of new research on allergies and the close relationship of such research with the study of infectious diseases. Investigations of allergy are closely allied to the science of immunology, which is also fundamental to investigation of the infectious and parasitic diseases. Recent estimates indicate that approximately 16 million persons in the United States suffer from some form of allergy and that some manifestation of allergy is experienced by at least 50 percent of all people at some time in their lives.

The institute will support long-term basic studies in these fields through grants to research scientists in universities and medical schools. A National Advisory Allergy and Infectious Diseases Council has been established to make recommendations to the Surgeon General of the Public Health Service regarding the new grant activities of the institute. The council held its first meeting March 7-8, 1956, at Bethesda, Md.

Members of the council are leaders in science, education, and public affairs. Except for two vacancies to be filled, all the members have been appointed. They are:

Drs. René J. Dubos, member of the Rockefeller Institute for Medical Research, New York; Gail M. Dack, director, Food Research Institute, University of Chicago; Edwin B. Fred, president, University of Wisconsin; Charles E. Smith, dean, School of Public Health, University of California at Berkeley; and H. O. Halvorson, head, department of bacteriology, University of Illinois.

Byron H. Larabee, president, Firestone Plantations Company, Akron, Ohio; David C. Crockett, associate director, Massachusetts General Hospital, Boston; Mrs. Rollin Brown, of Los Angeles, president, National Congress of Parents and Teachers; and John Abbink, of New York, president, American Foundation for Tropical Medicine.

Dynamic Impact of Advancing Technology on Environment and Health

By MARK D. HOLLIS

WITHIN the short period of 50 years, Western civilization has compressed more major technological changes than had occurred in all its previous 2,000 years. Since 1900 we have witnessed the birth of the automotive age, of aviation, and of mass production techniques. Developments in electronics, chemotherapy, and jet propulsion have appeared since 1930. Synthetics—apart from celluloid and bakelite, almost unknown in 1930—are now commonplace. More than a half million synthetic compounds are in production and use—in construction, in household products, in clothing, and in foods. We often speak of the 900-percent increase in industrial production since 1900 without noting that more than half of this increase has occurred since 1940. And now, to all of this, is added nuclear energy—the atomic age with its fantastic potential for good and for evil.

But by all signs, this is only the beginning. Already on the horizon are such techniques as irradiation of foods, rocket transportation, electrification of solar energy (now operating

a telephone circuit in Georgia), and a host of other potentials.

Attitudes Concerning Change

One thing is clear: In your life span there will be an avalanche of change such as we have never known.

Much of the world is unaware of what is in its grasp. I returned last month from a trip through several of the areas of the world which have been barely touched by technical advances, if at all. To me the striking characteristic in these countries was not their primitive sanitation but their inertia toward change. One senses a hopeless resignation to the open sewers and open sores, to the appalling rates of infant mortality, to decrepit old age at 40, to acceptance of drudgery, disease, and despair. We in the United States, always a Nation of restless pioneers, generation by generation, have displayed no vested interest or ingrained habits that compel us to do things in old ways, if new ways are better. Oscar Wilde said: "The longer I live the more keenly I feel that whatever was good enough for our fathers is not good enough for us."

It is this heritage that makes possible new developments so swiftly achieved that we have little time to adjust our minds to the changes and to understand their full significance. The tenor of the times is reflected in our increased living pace—at home, at work, and at play.

Mr. Hollis is Assistant Surgeon General and chief engineer of the Public Health Service. At the mid-year commencement exercises of the University of Florida, January 28, 1956, he made this address, somewhat abridged here, upon receiving the honorary doctor of science degree.

Scarcely a new product brought on the market today can expect to make the grade unless it can be advertised as doing something faster. Detergents wash clothes faster. Household equipment bakes pies, roasts meat, washes dishes, and cools houses—faster. Industrial and business machines accomplish all sorts of tasks—faster. Communication and transportation—all work and get there faster.

Yet all this timesaving has not added even a split-second to our 24-hour day. Instead, the individual is pushed at a faster and faster pace, an endless response to alarm clocks, television, and superpowered automobiles. All this leaves him little opportunity—and less time—to think, to understand himself, his fellow human beings, and the complex environment in which he lives. Yet how much we need this understanding, not only as individual men and women but also as members of families and communities, of our place among all peoples in a shrinking world. Because only through understanding can we make wise decisions as to constructive use of our unprecedented technology. And if ever we needed wise decisions this is the hour.

Science and Technology

So let us pause to recall a distinction between basic science and technology. The scientific foundations of our understanding of physical laws have been laid slowly by the world's great thinkers through many ages. Modern technology, the prompt and effective application of basic science to practical use, is a product of this era, developed largely since we were born.

Until fairly recent years there was little direct association between the basic scientist and the technologist. G. K. Chesterton, who died in 1936, wrote of this wide gap between the scientific mind and the consequences of the knowledge produced by scientific thought:

"When a man splits a grain of sand," he said, "and the universe is turned upside down in consequence, it is difficult to realize that, to the man who did it, the splitting of the grain is the great affair, and capsizing of the cosmos quite a small one."

There now exists much closer collaboration between the scientist and the technologist, and

even more significant, between both these experts and society. As a result, each scientific discovery, promptly flashed to our network of research institutions, sets off a chain reaction emitting dozens of new discoveries.

Modern industries are ready, willing, and equipped to transform the scientific report or the laboratory demonstration into new or improved products. For example, you are familiar with the rapid development of the frozen-juice concentrate industry in Florida. I never cease to be amazed at the production reports on this industry. One producer said, "We expected much, and got much more."

What Is Environmental Health?

There exists a close interplay between technology and environmental health. And this interplay becomes closer and more involved as technology moves ahead.

Some of you may ask, "What is environmental health?" This term has come into use in recent years, and no precise definition has been accepted even by the professional groups who use it most frequently. In 1948, the World Health Organization defined human health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." Paraphrasing this statement, we might say that environmental health is a state in which man's environment contributes to his physical, mental, and social well-being and is not merely the absence of environmental hazards to personal health.

We may well accept such a proposition, for man and his environment are indivisible. Ordinarily we think of man as master of his environment, molding it to meet his needs. But it is more realistic to think of the environment and man as molding and changing each other simultaneously.

Environment is a broad term and each facet has its impact on public health. For instance, many people associate alcoholism with the social environment; accidents with the psychological environment. However, let us consider environmental health as it refers to the physical environment—to air, water, food, and shelter. Of these basic essentials, air and water in particular gain importance as our changing

technology shapes our Nation more and more into a complex of metropolitan centers.

Water Resources

Concentrations of people in a technological environment are bound to create all sorts of wastes which pollute and deteriorate the air and water resources. In nature, both air and water have an unusual capacity for absorbing and purifying man-made pollution—up to a point. So long as human activity does not overtax nature, air and water resources remain essentially clean and safe. In our accelerating technology, we do overtax these resources. Corrective practices to preserve a balance acceptable to all interests are not always easy.

Across the Nation, our water resource is becoming a problem of top priority. Available supplies are being increasingly taxed. In many areas, shortages already threaten to halt further expansion. The water problem is one of increasing demands, seasonal shortages, floods, and pollution.

The average urban dweller uses 150 gallons of water per day. Thirty years ago, one person used only 20 gallons per day. There were then few if any laundromats, dishwashers, and air conditioners. The water that goes into production of things you eat and wear and use raises the national per capita requirement to 1,500 gallons per day. By 1975, these water demands will double—expressed on an annual basis, a million gallons per capita for a population of about 200 million.

Industries that need large amounts of water, and that is most of them, will go where it is. And by and large the population will go where industry goes. It is just as simple as that and at the same time just as complicated from the standpoint of future economic, social, and environmental adjustments.

Water Conservation

The mere availability of water represents only half the picture. As water use increases, pollution increases. What we face, therefore, is a vicious cycle—more water needed, to support more activity, to produce more wastes, to pollute more water. The answer involves a

variety of water conservation measures. Of these, pollution abatement is essential to permit re-use of the water as streams flow from city to city. And remember that 80 million people depend on surface streams for their drinking water.

When I was a boy, three expressions often used were: "cheap as dirt"; "free as water"; and "easy as breathing." The zooming prices of real estate knocked out the first. Water shortage is taking care of the second. And now even the third may have to be qualified. In some areas, the air is not so easy to breathe.

Air Pollution

Twenty years ago, community air pollution was quite localized and was primarily a problem of smoke abatement. Then in 1948, 5 smoggy days at Donora, Pa., made thousands ill and caused at least 20 deaths. In London, England, in 1952, 7 days of smog implicated air pollution in 4,000 deaths. These episodes should not be dismissed entirely as freak situations.

Less dramatic smog episodes build up from time to time in most of our metropolitan areas. The reality is that the community air supply, like water supply, has limitations. Florida has her water problems, but California leads in the smog problem department. Los Angeles is the best example of a city in our changing technology that is overtaxing its air supply.

In highly developed areas we simply cannot go on forever spewing more and more complex contaminants into the atmosphere without inevitable consequences to public health and community well-being.

We must expect some deterioration of community air resources in this age of ours. The job, as with water, is to limit depreciation in keeping with the entire development of the area.

You may ask, "Why this sudden concern about community wastes reaching air and water?" A popular belief is that it should be simple and easy to purify such wastes before discharge. On the contrary, proper control is both complex and expensive. Water pollution abatement alone will cost a billion dollars a year of somebody's money.

In earlier years, wastes were piped to the edge of town and given only superficial treatment—often no treatment at all. Factories too were located on the edge of town with stack discharges to the atmosphere. In those days water and air resources were able to absorb community contaminants without undue harmful effects. At worst, factories produced merely local nuisances.

Changing Character of Wastes

Today, in our metropolitan and industrial complexes, the situation is vastly different. Not only is technology advancing but metropolitan population is increasing—already up 35 percent since 1940. Now a hundred million people live in metropolitan areas of the United States. And for the most part, there is no longer an edge of town. The city blends into the suburban areas, also thickly populated and industrialized; the suburbs into ex-urbia areas, where people use the same water resources and experience the same smog; and vice versa to the next city. In addition, there is the ever-increasing volume of waste. And, most troublesome of all, an increasing complexity in the character of wastes.

Modern cities, with all their diverse activities, discharge thousands of tons of contaminants to air and water every hour. In the chemical complex involving countless new compounds, the resulting actions and reactions, continually occurring in air and water, produce situations extremely difficult to measure and even more difficult to understand. The atomic age introduces an entirely new set of terms, equations, and factors. Radioactive contamination does not follow our set patterns and established formulas of dispersion, dilution, and biochemical actions. Man's ability to control this impact of waste on the physical environment will be a significant factor in future metropolitan growth and development.

By all of this I do not mean to imply that we can quantitate the effects on personal health of contaminants in our physical environment. There is much we have to learn on this score. However, in many areas, these contaminants are causing physical discomfort, economic blight, and agricultural damage. But remem-

ber we are talking about accelerating technology. When we project present trends over the next two decades, the concentrations of contaminants in air and water do have a sobering implication—not only with respect to personal health but even more so to mental and social well-being. We must develop the understanding and remedial practices now to minimize these future difficulties.

What we need most is a better understanding of behavior and effects of contaminants in air and water. To produce this knowledge will require a much broader research effort. Universities and other research institutions should assume leadership in this effort.

On the industrial side, industry officials have an understandable reluctance to accept blame for all the atmospheric and water pollution. Actually, the responsibility is about evenly divided between industrial operations, *per se*, and public use of the fruits of industrial technology. Air is contaminated by the family car, home fuels, rubbish burning, and the like. Water is contaminated by home laundries, dishwashers, garbage grinders, and so on. From my experience, I am convinced that responsible industry is willing to use its research facilities to adjust its processes in line with a sound control plan. A prerequisite, however, is to know specifically what contaminants from industrial processes are hazardous and at what concentrations. And in our changing situation this is quite a task.

It is obvious that technology has created many problems in environmental health. It has, on the other hand, contributed much to the improvement in our well-being and comfort. It has given us the highest average standard of living the world has ever known.

It has been of direct assistance in providing the United States with remarkably safe public water supplies, by far the best in the world. It has improved food processing and packaging, housing, insect control, and a host of other environmental health measures.

Indirectly, the potential of cheap power from nuclear sources will place in the hands of the engineer a much wider range of possibilities. Reclamation of sea water, talked about for ages, is moving toward practical reality with such developments as the permionic membrane.

Weather modification, although still in the exploratory stage, has intriguing possibilities. Automation, too, will find increasing application in the environmental health field.

Now to shift gears for a moment. The engineering and technical aspects of pollution control likely will be less difficult in the long run than the related political, economic, and legal considerations. Pollution of air and water more and more influences the patterns of metropolitan growth and land use. The degree of regulatory control, how it is applied, and especially where it is centered, raises important and fundamental questions.

Effects of pollution are seldom limited to one political jurisdiction. Always difficult is the question of financing necessary remedial measures. Even more difficult is the process of ob-

taining agreement among various interests for the best use of environmental resources. There is real need for public awareness and for public understanding. The situation cannot be corrected by merely opening a window or turning a valve.

If the pollution problems of the future are to be met and managed, coordinated city and regional planning must be the basis. This must integrate the social, political, legal, and economic factors with the technical ones. Each State needs to appraise its problems realistically and to develop a framework which will foster a partnership participation by other public and private interests. This will require a degree of effort much better organized and much better understood by the public than are our present practices.

Research in Hospital Facilities Field

Grants for research projects to develop new knowledge about hospitals, health services, and health facilities were awarded in February 1956 by the Public Health Service to Yale University, Sinai Hospital, Baltimore, St. Mary's Hospital, Evansville, Ind., Health Insurance Plan of Greater New York, and the American Hospital Association. The grants were awarded, upon recommendation of the Federal Hospital Council, from the recent appropriations under the Hospital Survey and Construction Act for research in the hospital facilities. Eleven grants were also awarded in December 1955.

Yale University will study factors which can be used to achieve maximum functional efficiency in hospital architectural design.

The Sinai Hospital project will demonstrate the extent to which the shortage of professional nurses can be alleviated by employing and training floor managers and general aides for nonprofessional hospital duties.

St. Mary's Hospital will evaluate its new plan to provide more individual care for patients and will demonstrate the reorganization and education necessary to success of the plan.

HIP will analyze available statistical information to determine the influence of a comprehensive medical care insurance program on hospital admissions, patients' length of stay, quality of service given, and hospital costs.

The American Hospital Association study will be a basic analysis of accomplishments over the past decade in planning and building hospitals and health facilities, including the effect of the Hill-Burton program, for the purpose of establishing new scientific guides to planning for future hospitals, nursing homes, rehabilitation centers, and diagnostic and treatment centers.

What Is Happening to Sponsored Training for Nurses?

By DONNA PEARCE, B.S., R.N.

IT IS ESSENTIAL that the professional competency of health workers keep pace with the expanding scope and increasing complexity of modern public health if a high quality of public health practice is to be maintained. Recognizing this principle, the authors of the Social Security Act of 1935 included among its purposes provision for the training of public health personnel. In the early years of the program authorized by this act, designated amounts of money were allotted to States for the specific purpose of developing qualified professional and technical personnel. Later, the State health departments allocated to training whatever amounts from Federal funds they deemed appropriate. In addition, limited funds from State and local appropriations have been used for training purposes. Such training, financially supported in whole or in part from Federal, State, and local health funds, has come to be known as sponsored training.

Nurses, representing the largest single group of professional workers in health departments, have figured prominently as recipients of sponsored training. Of the 6,674 trainees who were sponsored for academic study in public health

during the years 1936 through 1944, 4,032 (60 percent) were nurses (1).

Federal grants-in-aid for health work reached their peak in fiscal year 1951. For grant-in-aid funds administered by the Public Health Service, the peak year was fiscal 1950; after that year, there was a rapid decline each year through fiscal 1954 (2). With this decline in Federal grants, there has been a growing professional concern as to the status of the sponsored training program. Because of this concern, an attempt has been made to find out what is happening to sponsored training for nurses.

For this study, data for an 8-year period, fiscal years 1947 through 1954, were analyzed. Data on the number of nurses who had received sponsored training during each fiscal year 1947 through 1952 had previously been obtained by the Division of State Grants, Public Health Service. For fiscal years 1953 and 1954, comparable data were obtained by the Public Health Service regional consultants through visits and correspondence with State health departments. (In this report, the term "State" includes the District of Columbia, Alaska, Hawaii, Puerto Rico, and the Virgin Islands.)

The data cover all full-time accredited training for periods varying in length from "less than 6 weeks" to 12 months. Accredited training refers to study for which academic credit is granted by a school of public health or by a university or college offering a public health

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Table 1. Number and percentage of nurses trained, by length of training period, and number of States participating in sponsored training for nurses, fiscal years 1947-54

Fiscal year	Nurses trained, by length of training period								Number of States participating	
	Total		Less than 6 weeks		6 weeks to 6 months		7 to 12 months			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
Total	6,194	100.0	1,367	22.7	3,203	53.3	1,446	24.0	53	
1947	608	100.0	63	10.4	411	67.6	134	22.0	45	
1948	¹ 1,005	² 100.0	351	42.4	367	44.4	109	13.2	45	
1949	1,490	100.0	269	18.0	943	63.3	278	18.7	49	
1950	1,185	100.0	225	19.0	712	60.9	248	20.1	47	
1951	689	100.0	160	23.2	280	40.7	249	36.1	47	
1952	500	100.0	140	28.0	214	42.8	146	29.2	45	
1953	411	100.0	106	25.8	147	35.8	158	38.4	45	
1954	306	100.0	53	17.3	129	42.1	124	40.6	41	

¹ Length of training not specified for 178 nurses.

² 100 percent = 827.

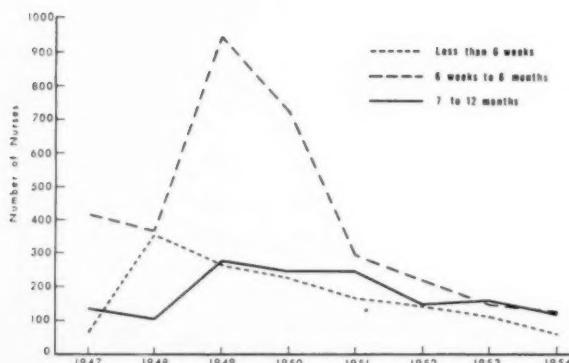
nursing program of study approved by the National League for Nursing.

The Trends

A total of 6,194 nurses received training during the 8-year period, as shown in table 1. This figure, however, does not necessarily represent the number of individual nurses, since some nurses may have received more than one period of training. For example, California has reported that 29 nurses received stipends for more than one type of accredited training during a 16-year period (3).

The peak year for sponsored training, in terms of both the number of nurses trained

Number of nurses who received sponsored public health training, by length of training period, 1947-54



and the number of States that sponsored training, was 1949 (see table 1 and chart). Each year since that date, there has been a steady decline in the number of nurses receiving training. From the year 1951 to the year 1954, there was a marked decrease.

The largest percentage (53.3) of the nurses received training for 6 weeks to 6 months. However, the percentage of those sponsored for 7 months to 12 months increased in both the years 1953 and 1954.

Of the 53 States, only 4 failed to sponsor training in 1949. In 1954, this number had grown to 12.

Table 2 shows that there was a widely varying range among the States in the number of nurses trained. Two States trained 32.8 percent of all the nurses, whereas 27 States trained only 10.8 percent. A review of the figures for individual States confirms the expectation that, in general, those with large metropolitan areas employing large numbers of nurses were the ones which trained the greater number of nurses. Massachusetts, with 1,082 trainees, and New York, with 984, were the two States that trained 400 or more nurses. All of the 18 States with a population of less than 1 million are included in the group that trained less than 50 nurses. And of the other 9 States in the less-than-50 group, 6 had populations of 1 to 3 million and 3 had between 3 and 4 million.

In interpreting the figures for number of nurses trained, however, variations in the proportion of long-term training periods to short-term periods must be considered. For example, of the 1,082 trainees in Massachusetts, only 16 received training for 7 to 12 months, whereas, of New York's 984 trainees, 426 received training for this length of time. California and North Carolina afford another example. Both of these States fell into the 100-399 category, but California reported that 104 of its 285 trainees received 7 to 12 months' training, whereas North Carolina had only 55 of a total of 296 trainees in this group.

Further analysis of the data for fiscal years 1953 and 1954 shows that 35 States sponsored training for periods of 7 to 12 months in 1953, whereas only 23 sponsored that type of training in 1954. One hundred fifty-eight nurses received training for 7 to 12 months in 1953, and 124, in 1954.

The Problem

The data presented show that since 1949 there has been a steady decrease in sponsored training for nurses in the United States as a whole, though not necessarily in every State. This decrease is a matter of real concern in view of the need for a continuation and expansion of training. According to the Public Health Service's 1955 census of public health nurses, only 42.2 percent of the nurses employed in State and local official health agencies on Jan-

Table 3. Number and percentage of nurses in State and local official health agencies who have had approved public health nursing education, 5-year intervals, 1940-55

Year	Number nurses employed	Nurses with 1 year or more of public health nursing education		Rate of increase in per- centage
		Number	Percent	
1940-----	9,347	2,151	23.0	
1945-----	11,414	3,395	29.7	29.1
1950-----	13,594	5,064	37.2	25.2
1955-----	14,152	5,969	42.2	13.4

uary 1 had had 1 year or more of public health nursing education.

Although there has been a decrease in Federal funds for training, these funds are not the only means of providing adequate training for public health nurses. The number of collegiate schools offering educational programs for the preparation of nurses for beginning positions in public health increased from 3 in 1947 to 33 in 1956 (4, 5). A few States are exploring the use of extension courses from universities with approved public health nursing programs as a means of improving the training level of currently employed nurses. Also, two States have obtained funds from their legislatures for the training of a limited number of public health nursing personnel, and still others plan to request such funds. In the 24 States in which universities with approved programs of study in public health nursing are located, nurses may be able to pursue their studies on a part-time basis. Greater efforts along these lines, particularly the use of extension courses, should help to offset the lag in sponsored training. However, still other methods of preparing nurses for public health work may have to be worked out.

The effect of the decline in sponsored training on the qualifications of nurses employed for public health work is not readily apparent, but a few facts that may be indicative can be cited. The percentage of nurses in State and local public health agencies who have had 1 year or more of public health nursing education was greater on January 1, 1955, (42.2 percent) than it was 2 years earlier (40.5 percent). However,

Table 2. Number of States and number and percentage of nurses trained according to the range in number of nurses who received sponsored training, fiscal years 1947-54

Range in number of nurses	Number of States within range	Nurses who received sponsored training		
		Number	Percent	
Total-----	53	6,194	100.0	
400 or more-----	12	2,030	32.8	
100-399-----	12	2,557	41.3	
50-99-----	12	938	15.1	
Less than 50-----	27	669	10.8	

¹ Numbers of nurses trained by these States were 984 and 1,082.

a comparison of the figures for 5-year intervals since 1940, in table 3, shows a definite deceleration in the rate of increase in the percentage of nurses with 1 year or more of public health nursing education.

Summary and Conclusions

Data for an 8-year period, fiscal years 1947 through 1954, show a steady decrease in the number of nurses receiving sponsored full-time accredited training since 1949. The decrease is more marked for the years 1951 through 1954 than for 1949 and 1950. Although the numbers of nurses trained were smaller in 1953 and 1954 than in previous years, the percentage of long-term (7 to 12 months) training periods increased in both years.

The number of States not sponsoring any training for nurses has increased since 1949. In 1949, 4 States did not sponsor training, and in 1954, 12 did not.

As might be expected, there was a wide variation among the States in the number of nurses trained. Twenty-seven States each sponsored less than 50 trainees. Two States each sponsored 900 or more.

The States are making some effort to make up the loss of Federal funds through State appropriations and through use of extension

courses from universities. The increase in the number of collegiate basic nursing schools approved for the preparation of nurses for beginning positions in public health nursing is another encouraging sign.

However, the decided slowing up in the rate of increase in the percentage of qualified nurses employed by State and local official agencies indicates that greater efforts will have to be made to offset the lag in sponsored training. In addition, ways must be found to extend and intensify training efforts at a rate consistent with the need to overcome present deficiencies and to meet future demands.

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OVR Appoints Advisers on Training Policy

The Office of Vocational Rehabilitation has appointed an Advisory Committee on Training Policy to help solve the nationwide shortage of persons trained to work with the handicapped.

The training program was established by Public Law 565, 83d Congress, in 1954 to increase the available supply of professional personnel whose skills are required in the vocational rehabilitation of disabled persons.

In the initial phases of the program, Federal grants have gone to educational institutions to help meet part of the cost of establishing or expanding curriculums in the shortage fields. Grants also have been made to individuals in such areas as social work, occupational therapy, psychology, nursing, rehabilitation center direction, rehabilitation counseling, medicine, and work with the visually and aurally handicapped.

Association of Vitamin B₆ Deficiency With Convulsions in Infants

By E. M. NELSON, Ph.D.

ONE WAY in which the Food and Drug Administration protects the consuming public is by monitoring the recovery from trade channels of any product, food, drug, or device that is found unsafe for use.

In 1953 such a program related to the occurrence of a series of cases of convulsions in infants that had been maintained on an infant food called SMA Liquid Formula (for convenience termed SMA liquid). The Food and Drug Administration's part in correlating the observations on these cases and in concluding that the condition was the result of a deficiency of vitamin B₆, although discussed at a conference on vitamin B₆ in human nutrition (1) and referred to by May (2), is not reflected in several other published reports of these cases (3-7).

Through its inspectors, the Food and Drug Administration assembled hospital records of a large number of affected infants. After careful study of these records by its medical and scientific staff and consideration of information gained from the manufacturer of the SMA liquid, particularly with respect to changes in composition of the product, it was possible to recognize interrelationships not apparent to the pediatricians who attended the individual cases.

Although at the time a confidential state-

ment containing this information was submitted to the National Institutes of Health, the Food and Nutrition Board, and the Council on Foods and Nutrition of the American Medical Association, it may be well to set forth, for a wider audience, the sequence of events that led to a recognition of the relation of vitamin B₆ to the infant convulsions. It is hoped that this will encourage prompt reporting of any unexplained disease condition that may be related to ingestion of a food or use of a drug, thereby enabling the Food and Drug Administration to take remedial steps at the earliest possible stage to safeguard the public.

Early in December 1952, the Food and Drug Administration received a letter from an Arkansas resident, a trained nurse, whose 3-month-old infant had developed convulsive seizures. She gave a complete and informative case history of her child, who had been fed SMA liquid from birth. The attending pediatrician apparently suspected the condition was associated with SMA liquid because he immediately changed the formula to evaporated milk and Karo syrup. Complete recovery from the convulsions resulted from this change. The mother then learned of eight similar cases in her community, all associated with the use of SMA liquid. All of the infants recovered from convulsions following a change of formula.

A short time later the director of the Arkansas Division of Food and Drug Control discussed the problem with our St. Louis district office, asking if we had received consumer com-

Dr. Nelson is chief of the Division of Nutrition of the Food and Drug Administration, Department of Health, Education, and Welfare.

plaints about SMA liquid. The manufacturing firm, we learned, was aware that the product was associated with infant convulsions. Of the 12 cases reported to the firm the majority had occurred in Arkansas and northern Texas, and the firm attributed the condition to a change in mineral content of water used to dilute the product for feeding. There had been a severe drought in the Arkansas-Texas area, and the attention of the firm was focused on a possible mineral imbalance that might cause the tetany-like syndrome.

Accumulative Evidence

In investigations during January and February of 1953, the Food and Drug Administration developed the following facts:

1. More than 50 cases of so-called SMA convulsions had occurred.

2. At this stage the majority of cases had been found in the Arkansas-Texas area.

3. Invariably the sick infants had been fed SMA liquid with no vitamin supplements. Similar symptoms and physical signs were noted in the affected infants. These included hyperirritability (particularly sensitivity to noise), diarrhea, and vomiting (frequently projectile), followed by convulsive seizures lasting from one-half to 5 minutes, and recurring from once or twice daily to as many as 11 times daily. Rectal temperatures ranged from 99° to 101° F.

4. The convulsions appeared in infants ranging in age from a few weeks to nearly 1 year.

5. The formula for SMA, both powder and liquid, had been changed some time prior to January 1952 by replacing the coconut oil in the fat by palm oil.

6. All cases of convulsions were traced to the new SMA liquid formula by codes containing the letters "H" or "I".

7. In every case reported there was relief from the convulsions when the food formula was changed.

8. No cases of convulsions were reported from the use of powdered SMA, which had the same basic composition as the liquid.

9. Sedatives relieved the convulsions some, but no other medication was effective.

10. There was no clue as to the causative agent

from chemical examinations of blood and urine or from clinical tests or clinical trials.

11. Samples of the product were found to be sterile.

12. Chemical examination of the product revealed nothing unusual.

13. Many of the infants whose case records came to our attention had been under the care of pediatricians, and thorough studies had not established the etiology of the convulsions.

14. Records of such cases were not found in those larger cities where hospitals were surveyed by food and drug inspectors.

Late in March 1953, in the Food and Drug Administration, the files on this subject were referred to the Division of Nutrition for study. It was noted that the irritability and convulsive seizures described in the case records resembled the symptoms in rats from mothers on a vitamin B₆ deficient diet that had been observed in the division's laboratories (8). The rapidity of the infants' response to a change in the formula was also characteristic of the animals' recovery from symptoms of deficiency with a change to an adequate diet. Such a prompt response is not usually observed in the treatment of a toxic condition.

The composition of SMA liquid was also a basis for suspecting nutritional deficiency. The product was made from skimmed milk to which fats, lactose, vitamins A, D, C, B₁, B₂, and niacin, and potassium carbonate and ferrous sulfate were added. The reduced proportion of milk solids was supposed to provide a level of protein simulating that of mother's milk, although with such modification the amounts of water-soluble nutrients of milk, including vitamin B₆, were similarly reduced.

Dr. O. L. Kline of the Division of Nutrition was the first to associate the symptoms observed with vitamin B₆ deficiency and to offer an explanation that was in harmony with all of the facts developed. That was in March 1953, more than 6 months after the first cases occurred and after 50 or 60 cases had been treated by physicians in many areas of the country. But if vitamin B₆ deficiency was the true cause of convulsions in the infants, two questions had to be answered: First, in what manner could the substitution of palm oil for coconut oil influence the vitamin B₆ content of the product

or requirements of the infants for this vitamin? And second, why should the deficiency occur with SMA liquid and not with SMA powder which had the same composition?

The Solution

The replacement of coconut oil by palm oil in the SMA products was based on the demonstration that this change resulted in stools that, in many respects, more nearly simulated the stools of breastfed infants. A substantial change was also observed in the intestinal flora, with a marked increase in numbers of *Lactobacillus bifidus*. Obviously, either the population of organisms requiring B₆ may be increased or the population of organisms that produce vitamin B₆ reduced as a result of this change in the fatty constituents of the product. Three studies reported in 1938 show an important relationship between vitamin B₆ requirement and the fat in the diet with particular reference to the nature of the unsaturated fatty acids present (9). Witten and Holman (10) have presented evidence that in the rat there is a need for pyridoxine for the synthesis of the more highly unsaturated fatty acids.

Experiments in our laboratory had indicated that although pyridoxine hydrochloride is stable when autoclaved at 15 pounds pressure at a pH of 7, the vitamin B₆ in natural products is reduced substantially by such heat treatment. Pyridoxal and pyridoxamine, forms of vitamin B₆ that occur in food, are types of compounds known to react, upon heating, with amino acids and sugars to form a complex which the animal cannot fully use (11, 12). SMA liquid is subjected to a process of heat sterilization, but SMA powder is not. Therefore, the liquid product may be expected to be lower in vitamin B₆ content than the powder.

In examining SMA liquid for vitamin B₆ content, we were unable to obtain satisfactory results because the chemical method in use for the examination of pharmaceutical products was not applicable to milk products. Attempts to produce convulsions or other evidence of vitamin B₆ deficiency in rats were unsuccessful since the low protein and high lactose content of the product are not adapted to the nutritional requirements of the rat.

More recent analytical evidence has clearly demonstrated that SMA liquid contained a lower level of vitamin B₆ than similar liquid infant formulas, and less than the amount found in the SMA powder. This confirmed our suspicion based upon knowledge of the composition and effect of processing.

A careful resurvey of the case records of the infants affected showed that in the few instances vitamin supplements had been used none of them contained vitamin B₆.

The general causes of convulsions in infants and the plausibility of the explanation offered in this instance were discussed with Dr. Irvin Kerlan and Dr. Leo Parmer of the FDA Division of Medicine. This discussion led to the referral of some of the case histories to Dr. L. Emmet Holt since he and his associates (13) had reported studies of vitamin B₆ deficiency in infants. After reviewing these cases, Dr. Holt expressed the view that the symptoms described resembled those he had observed. The Division of Medicine then urged pediatricians to test clinically the effect of pyridoxine hydrochloride in infants showing SMA convulsions without changing the feeding formula.

Early in May investigations of hospital records revealed the occurrence of more than 50 cases of SMA convulsions in the vicinity of Lancaster, Pa. Additional occurrences were reported at Walter Reed Hospital in Washington, D. C., brought in from widely separated Army installations. Also, called to our attention were reports of three new cases in areas where it was thought the offending product had been replaced by a new formula. A more effective and complete recall of codes under suspicion began on May 15. Two weeks later a nationwide check by the Food and Drug Administration to determine the thoroughness of this recall indicated that it was reasonably complete, although there were instances in which confusion arose in identifying the codes and in which there was some uncertainty about the amounts in the hands of individual purchasers. More than a million cans of the suspect product were removed from the market.

On May 29 the Food and Drug Administration was advised by telephone that Dr. Charles D. May of the University of Iowa had treated an infant showing SMA convulsions by intra-

muscular administration of pyridoxine hydrochloride, while maintaining the infant on the SMA liquid. The infant recovered completely from convulsions. This report was confirmed by letter from Dr. May a few days later. Confirming reports from other investigators followed within a short time. With confirmation of the relationship of SMA convulsions and vitamin B₆ intake in infants, the manufacturer added pyridoxine hydrochloride to the product. It appears that several weeks were required for complete replacement of old stocks, since we learned of a few cases of the illness as late as September 1953, even after the palm oil was eliminated and the old formula reestablished (14). In the succeeding 2 years no additional occurrences of convulsions were reported.

It is significant that the majority of cases of infant convulsions occurred in rural areas rather than in the larger cities where the large proportion of infants are under the care of pediatricians. The prevailing practice by many pediatricians of supplementing liquid formulas with solid foods and vitamin preparations at an early age may not be followed in some rural areas. It is significant, also, that more than a hundred cases of vitamin B₆ deficiency occurred in this country before the condition was recognized as a deficiency disease.

With constant improvement in food processing, acceptable methods are needed for determining the nutritional adequacy of infant foods. For products in which the lactose is increased to simulate mother's milk, the classical biological test with the rat is impracticable because of intolerance to lactose.

The Food and Drug Administration is in a particularly favorable position to assist public health officials and the medical profession in bringing under control disease outbreaks or unusual reactions that are related in any way to the use of foods or drugs. With its investigational authority and its experienced investigational staff, facts may be collected without delay for review by the medical and scientific staff. It would be helpful if there were prompt reporting to the Food and Drug Administration of occurrences of unexplained disease con-

ditions or unusual reactions, particularly where association with the use of a particular food or drug is suspected. In such reports it is very helpful to have the complete case history and the codes or batch marks of the suspected product.

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PHS films

Embryonated Egg Techniques for Virus Studies

35 mm. Filmstrip, black and white, sound, 11 minutes, 59 frames, 1955.

Audience: Trainees in virology techniques, virus laboratory directors, and technicians.

Available: Loan—Public Health Service, Communicable Disease Center, 50 7th St. NE, Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Serving as an introduction to embryonated egg methods for isolating viruses in virus laboratories, public



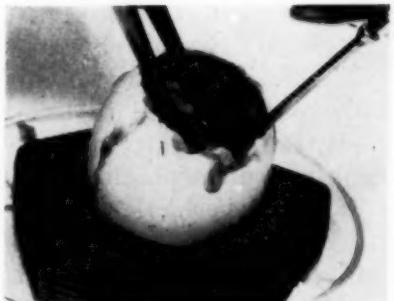
Anatomy of embryonated egg.

Applications of these processes to the yolk sac, allantoic fluid, chorio-allantoic membrane, and amniotic cavity are pictured. Both the "window" and the direct procedure for inoculating the amniotic cavity are shown.



Inoculation of chorio-allantoic membrane.

health laboratories, and medical schools, this filmstrip illustrates several egg inoculating and harvesting techniques.



Harvesting allantoic fluid.

Disaster Aid—Public Health Aspects

16 mm. Film, black and white, sound, 11 minutes, 1955.

Audience: Health officers, sanitarians, and sanitary engineers on emergency sanitation.

Available: Loan—Public Health Service, Communicable Disease Center, 50 7th St. NE, Atlanta 23, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Designed to show the methods used to solve health problems created by natural disasters, this film de-



Emergency immunization carried out as a flood relief measure.

picts work carried out by the Communicable Disease Center and other disaster relief agencies during flood conditions.

It documents the efforts of local, State, and Federal health agencies

and emphasizes the distinct role of each in combating the dangers to public health arising from an actual flood situation.



Mobile water purification unit for disaster relief.

A Plant Health Program

35 mm. Filmstrip, sound, black and white, 14 minutes, 54 frames, 1955.

Audience: Health department personnel, physicians, nurses, management, and labor.

Available: Loan—State health departments; Public Health Service regional offices; and Occupational Health Program, Public Health Service, U. S. Department of Health, Education, and Welfare, Washington 25, D. C. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.

Interest in employee health programs is greater than ever before, and such programs are being developed in increasing numbers.

Management, labor, and the health professions are all affected, directly or indirectly, by this development. Financed by management, employee health services are provided at, or through, the place of work. More and more, they are being recognized as an indispensable means of keeping the worker healthy and on the job.

This filmstrip tells the story behind employee health services. By taking the viewer to a printing plant in Louisville, Ky., to watch an employee health program in operation, it helps to answer such questions as: Why are employee health programs being established? What services do they provide? What do they accomplish?

Protect Your Family Against Poisoning

By IRVIN KERLAN, M.D.

MORBIDITY and mortality statistics reveal a high frequency of poisoning from accidental ingestion and other types of misuse of drugs and household chemicals by young children. Parents need to know more about how to protect their families from such accidents.

The prevention of accidental poisoning in the home has been an active undertaking of the American Academy of Pediatrics Committee on Accident Prevention, the American Medical Association Committee on Toxicology, and the American Public Health Association Subcommittee on Chemical Poisons.

Government representatives of the Public Health Service, the Food and Drug Administration, and the Agricultural Research Service of the United States Department of Agriculture are members of the committees. The National Safety Council, the American Red Cross, pharmaceutical organizations, drug manufacturers, medical societies, health departments, insurance companies, and others concerned with the safe distribution of drugs are also engaged in averting misuse of drugs and household

chemicals through label warnings, directions, special packaging, and educational programs.

Although gains are to be expected through special educational efforts and informative labeling of drugs and economic and caustic poisons, further progress can be made through a leaflet which may be prominently placed in the bathroom or kitchen where it will serve to remind the family how to safeguard the daily handling and storing of the many potentially harmful substances so prevalent in the home.

This thought led to the publication of "Protect Your Family Against Poisoning" as a pilot project of the Food and Drug Administration to encourage use of the pamphlet by health groups, food and drug manufacturers and distributors, leaders in safety education, and publishers, in reaching persons in the home. The Administration will gladly grant permission for reprinting the circular.

Almost all 10,000 copies of the circular printed in November 1955 have been distributed. The leaflet has received many commendations for its practical usefulness. So far, it has been reproduced or cited in a number of health journals and pharmaceutical publications. It has been presented on radio and television shows and mentioned in speeches by government officials. The National Safety Council has reprinted the pamphlet and so have State, county, and city health departments.

Through the reprinting by one pharmaceutical wholesaler in its safety booklet, 1,250,000 copies will become available. An estimated half million copies have already been printed by *FDC Reports* and *FDC Drug Letter* for distribution by retail druggists to their customers.

Dr. Kerlan, the author of "Protect Your Family Against Poisoning," is associate medical director, Food and Drug Administration, Department of Health, Education, and Welfare. The photographs on the opposite page are provided through the courtesy of Dr. Charles M. Cameron, Jr., associate professor of public health administration, University of North Carolina School of Public Health. The pictures are of his own children.



Beneath the kitchen sink may be a handy place for storage, but it's also within reach of busy little hands. "Protect Your Family Against Poisoning" reminds us to keep all drugs, poisons, and other household chemicals out of reach of children and away from foods . . . to safeguard brightly colored capsules and tablets that look like candy . . . to warn youngsters not to eat or drink any drugs and chemicals they find.

Turn to next page for text of leaflet.



Text of Pamphlet on Poisoning

Keep this where you will see it often.

- In the event of an accident, immediately call a physician or the nearest hospital.
- Keep all drugs, poisons, and other household chemicals out of the reach of children and away from food.
- Lock up all dangerous substances.
- Do not store poisonous or inflammable substances (kerosene, gasoline, rat poisons, and so on) in food or beverage containers.
- Read all labels and carefully follow "caution" statements. Even if a chemical is not labeled "poison," incorrect use may be dangerous.
- Do not eat or serve foods which smell or look abnormal and remember that they may poison household and farm animals.
- Be sure all poisons are clearly marked. This can be done by sealing with adhesive tape or using a special marker.
- When you throw away drugs or hazardous materials be sure the contents cannot be reached by children or pets.
- Warn small children not to eat or drink drugs, chemicals, plants, or berries they find, without your permission. Insist on this.
- Use cleaning fluids with adequate ventilation only, and avoid breathing vapors.

- Protect your skin and eyes when using insect poisons, weed killers, solvents, and cleaning agents. Be sure to wash thoroughly after use of such things and promptly remove contaminated clothing.
 - Do not allow food or food utensils to become contaminated when using insect sprays, aerosol mists, rat poisons, weed killers, or cleaning agents.
 - Do not take or give medicine in the dark. Be sure you can clearly read the label on the container.
 - When measuring drugs give it your full attention. Give infants and young children drugs only as directed by your physician.
 - Before measuring liquid medicine always shake the bottle thoroughly.
 - Safeguard tablets which are candied, flavored or colored, since children eat them like candy.
 - Do not take medicine from an unlabeled bottle—transparent tape over the label will protect it.
 - Date all drug supplies when you buy them.
 - Weed out the left-overs regularly from your medicine chest—especially any prescription drug that your physician ordered for a particular illness.
 - Use a prescription drug only for the patient for whom the physician ordered it.
 - Read all directions and caution statements on the drug label each time you plan to use it.
-

Local health departments in California are increasing their services and activities to meet the needs of the chronically ill in their communities.

California's Chronic Disease Activities

By LESTER BRESLOW, M.D., M.P.H., NANCY OTT, M.P.H., and VIVIAN CHIN, B.S.

IN 1950, the California Conference of Local Health Officers adopted in principle a guide, Chronic Disease Control Program in Local Health Departments. This guide defined some chronic disease control activities which local health departments might incorporate into their regular programs. Suggested activities in control of cancer, heart disease, diabetes, obesity, crippling conditions, and chronic alcoholism were listed. For each of these categories, items were suggested which "can be incorporated into most current programs," and which "could be added to many current programs."

By 1953, interest in this new area of public health endeavor had developed to the point that the conference requested the California State Department of Public Health to survey current local health department activities in the field. The bureau of chronic diseases undertook this task during the first 6 months of 1954, in cooperation with the department's consultants in the several public health specialties—health education, laboratories, nutrition, public health nursing, records and statistics, and social serv-

ice—which most closely pertain to chronic disease control. Advice and assistance were also obtained from a committee of the conference of local health officers, and from the division of local health services in the State health department.

A form was designed to obtain information on (a) general activities (special studies and projects in the chronic disease field, liaison with voluntary health agencies, participation in development of community services for chronic illness); (b) case-finding services for chronic disease; and (c) activities in the six special public health fields mentioned above. These three categories included 45 separate items.

The information was obtained in two ways. In some instances, individual consultants of the State health department gathered data from the local health departments in the course of their regular visits. In about half the departments, the data were obtained in a group conference, in which the consultants met with the local health officer and his staff, at the request of the health officer. In each case, a physician from the State health department recorded the information in the first two categories—general activities and case-finding services. A departmentwide meeting of the local health department was devoted to this survey in several counties.

The survey covered 49 of California's 52 full-time health departments. For local reasons, such as temporary absence of the health officer, the information was not obtained for three departments. A summary of the data

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supplied by the 49 departments for each major section of the questionnaire follows.

General Activities

Nineteen local health departments reported that they had carried out special projects in the chronic disease field during the past 5 years. These included multiphasic screening, special cancer studies, bedside nursing care for the chronically ill, education on health aspects of aging, and studies of the need for chronic disease hospitals, sheltered workshops, and other facilities.

Most departments maintain close liaison with the county chapters of the American Heart Association, American Cancer Society, and other voluntary health organizations active in the field of chronic disease. Usually the health officer, the director of public health nursing, the health educator, or other members of the staff serve on boards or committees of these organizations, thus aiding in the planning and development of a communitywide attack on chronic illness problems.

About two-thirds of the 49 departments indicated that they have taken leadership or joined with other organizations in promoting community services important in the control of chronic disease—for example, rehabilitation services, casework and housekeeping services, resources for the treatment of alcoholism, and tumor clinics. The health officer in one county took the leadership in getting a new wing for chronically ill patients at the county hospital, and he meets regularly with the county hospital staff to consider problems of the chronically ill.

Most departments maintain in some form current information on services for the chronically ill available in the community, for use of department staff members. As yet, however, little has been done in the way of organized staff education (in local departments) on chronic disease control, or in staff participation in planning such education.

Case-Finding Services

California's local health departments each year provide some type of clinical services to

several hundred thousand persons, including both children and adults. Many of these departments reported that they were taking additional advantage of these services for the detection of chronic disease, thus getting patients under care early and minimizing the likelihood of disability or premature death. Opportunities for such case finding have been recognized in conjunction with the usual venereal disease, maternity, child health, and preemployment clinics and as an adjunct to such established activities as tuberculosis case finding. A few departments have also carried on special chronic disease case finding.

The survey showed that 16 departments have included, or are including as part of their clinical services, one or more tests for the detection of such chronic conditions as diabetes, cancer, and heart disease. Also, in the course of their regular services, they are observing and counseling patients regarding obesity. One local department reported blood sugar screening on all venereal disease patients. Approximately 20 departments conduct maternity clinics and routinely run urine sugar tests on patients; thus, they have an opportunity in diabetes detection. Another department does a cytology test for cancer on its clinic patients and is also carrying on a cooperative program of such screening with the county hospital. Arrangements have been made in this program to include women attending obstetrics and gynecology clinics and those entering the county rehabilitation center, as well as health department staff members who wish to participate. When abnormalities are found, the patients are referred to their own physicians or to the county hospital, as appropriate, for followup diagnostic examinations and care.

According to reports received, over two-thirds of the local departments conduct some chest X-ray screening service. Although this is primarily for tuberculosis, case finding for lung cancer and heart disease is also done. In many instances, lung cancer suspects are called back for secondary films and are followed as intensively as tuberculosis suspects. Heart disease suspected from chest X-ray films generally receives less attention; only about one-third of the departments call such patients back for secondary films. Usually the patients receive only

a letter indicating the desirability of seeing a physician.

Six departments have carried on chronic disease case finding by means of multiphasic screening programs, ordinarily in cooperation with voluntary health organizations and county medical associations. Several others have engaged in some organized case-finding services for cancer, heart disease, diabetes, or other chronic diseases as separate conditions.

Records and Statistics

Only about one-third of California's local health departments include statistical personnel on the staff. However, most departments do prepare chronic disease mortality data for use in annual reports, monthly bulletins, and talks by physicians and others. Morbidity data concerning chronic diseases are scanty. In a few instances, departments indicated that they have prepared reports concerning nursing, case finding, or other services for chronic disease. Approximately 40 departments reported that they assist hospitals and other agencies in the follow-up of cancer patients or other chronically ill patients at least through search of death certificates and other health department records. Some also provide occasional statistical services to other agencies studying chronic disease in the community.

Public Health Nursing Service

Reports from the local departments indicate that in practically all local health jurisdictions in California nursing service has become a "generalized service," with attention to the entire household, not just to the sick child or the tuberculosis suspect. The public health nurse in her home visits is usually aware of possible chronic disease in family members and offers help in making use of available screening services and other community resources. Often she encourages regular physical examinations and makes suggestions on home safety.

Public health nurses in local health department clinics are alert to the possibility of chronic disease, noting obesity and other signs which may indicate need for attention. In the

schools, the nurses often orient teachers to the possible significance of overweight and provide educational materials for school personnel and students on cancer, heart disease, diabetes, and other chronic diseases. When, in community contacts, they are asked for suggestions for meetings of various groups, many public health nurses arrange for use of educational films and other resources on chronic disease supplied by the local health department.

Two local health departments reported that they give bedside care upon request, with no restrictions. Seven other departments noted that they provide some degree of bedside nursing care for the chronically ill, beyond demonstration teaching.

Answers to questions about followup of patients showed that, in general, public health nurses were giving more attention to poliomyelitis patients than to patients who have rheumatic fever and other chronic diseases.

The majority of public health nurses in the State now have access to and utilize other specialties important to adequate care of patients with chronic illness, for example, social work, nutrition, physical and occupational therapy, rehabilitation, and psychiatry.

Social Service

Nine of the surveyed health departments include social workers as members of the staff. In addition, most departments state that they utilize social service consultation from other agencies, both those in the community and from the State health department. Wide variation was reported in resources for referral. The urban areas usually have access to many public and private agencies, and the less populated areas sometimes have only the county welfare department as a resource.

According to reports received, every health department takes some responsibility for helping chronically ill persons obtain financial, medical, rehabilitation, and casework assistance. During a multiphasic survey in one of these local health departments, the medical social worker met several times with a group of obese patients to help them discuss some of their problems in staying on diets. The social workers

in another department offered individual help to chest clinic patients who were potential cardiac or cancer patients to assist them in seeking care elsewhere and in making use of resources available to them. Only a few departments provide social services directly to patients; generally, health department staff members refer patients with such problems to other community resources. Although each health department did not specifically indicate its procedure, nine noted that they follow up either with the patient or the agency to determine whether the patient received the service for which he was referred.

Nutrition Service

Only 6 of the 49 local health departments reported nutritionists as members of the staff, but most departments avail themselves of nutrition consultation from the State health department and from other local agencies.

Local health department staff members (usually the nutritionist or public health nurse) are sometimes called upon to interpret special diets prescribed by physicians for patients with diabetes, cardiovascular disease, and obesity. They also appear to be aware of the diet policies of other public agencies, such as welfare departments and county hospitals.

Only one health department reported having sponsored a course on nutrition in diabetes. However, seven departments stated that their public health nurses are working with groups of school children on weight control. In four agencies, nutritionists or public health nurses have been serving as group leaders with groups of obese adults. In five instances, weight-control groups have started among the staff members of the health departments themselves. Weight-control education on a group basis has progressed almost exclusively in urban areas.

Several departments have arranged for nutrition consultation to institutions caring for the chronically ill, either by local staff members or from the State health department.

In one department, the nutrition consultant conducted an education program for the nursing staff on the nutritional aspects of chronic disease, covering problems in diabetes, rheumatic fever, adult health, and obesity. One

interesting method of staff education has been the preparation of low-calorie luncheons by the nurses for the whole department, with supervision by the staff nutritionist.

Health Education

In 22 of the surveyed agencies, health educators are members of the staff.

Practically all health departments provide and distribute some chronic disease educational materials to community agencies, schools and colleges, clinics, and other appropriate groups. Several have participated in exhibits on chronic disease, for example, at county fairs. Some health departments indicated that they provide assistance to schools and colleges in planning a curriculum concerned with chronic disease.

About half of the local health departments report staff participation in providing for the community some type of group learning experiences related to chronic disease. Eleven departments have given assistance with programs on chronic disease to other agencies and community groups. For example, one department aided the county medical society with a special diabetes program designed to reach men's groups. Another worked with the local chapter of the American Cancer Society in developing a group discussion program for agricultural workers. A third assisted the county branch of the American Heart Association in putting on a symposium on heart disease. In another county, the health department provided assistance to the adult education division of the county schools and other groups in developing and carrying out a course on problems of aging.

In addition to the liaison that most departments maintain with county chapters of the American Cancer Society, one department reported that it carries out regular joint planning of educational activities with the local society. These include inservice education for public health nurses serving county schools, in the use of approved cancer education kits as teacher resources. Another department reports having discussed cancer and some other chronic diseases at joint staff meetings with the county schools curriculum committee. The health de-

partment staff in one county works regularly with the Aging Committee of the County Welfare Council.

Laboratory Services

For the most part, laboratory services are available only to patients coming to health department clinics for tuberculosis, rheumatic fever, or prenatal care, and for civil service employment examinations and the like. These services generally include urinalysis, blood sugar determination, hemoglobin determination, and blood counts. A few departments provide only certain clinical laboratory services, which are usually furnished by department contract with an outside clinical laboratory.

Seven health department laboratories reported that they provide a variety of clinical procedures, such as antistreptolysin titers and sedimentation rates. In 3 others, these services are provided by the department jointly with the county hospital; in 8, the laboratory work is done entirely by the county hospital, private clinical laboratories, or a combination of both.

One interesting development is a cytology screening service for cervical cancer which is operated by a county health department laboratory primarily for patients in county hospital clinics. Two other departments provide blood sugar screening for detection of diabetes. Some of the larger departments which have responsibility for rheumatic fever services utilize electrocardiograms. In a few instances, these are used also in preemployment examinations for civil service personnel. Several of the local health department laboratories have been involved in multiphasic screening programs.

Ten departments reported that they have been consulting with county medical societies and other professional groups to develop technical mechanisms for chronic disease detection.

Summary

A majority of the local health departments in California which took part in a survey of current activities in 1954 stated that they had done one or more of the following: carried out special projects in chronic disease control; maintained close liaison with voluntary organi-

zations active in this field; and either taken leadership or joined with other groups in promoting community services for the chronically ill. Although there had not been much special chronic disease case-finding effort at the time of the survey, local health departments were beginning to take advantage of their regular clinics for this purpose. Public health laboratory work is also being redirected to cope with growing problems in chronic disease. Forty of the forty-nine departments indicated that their records and statistics personnel assist hospitals and other agencies in followup of cancer or other chronically ill patients through search of death certificates and other health department records.

In the past, health department nurses have generally limited their activity in the field of bedside care to demonstration services. The intent has been to train a responsible member of the family to continue it. Recently, several factors appear to be forcing a change in this policy: smaller families and household separation of the generations; the need for close supervision in certain forms of therapy for chronic disease, such as the administration of drugs; and increasing public pressure for home care of long-term illness as an alternative to institutional care. Of all direct services to chronically ill patients, bedside nursing care now appears to be attracting the greatest attention on the part of public health administrators. Administrators of public health nursing services are actively considering the extent to which public health nurses should provide bedside nursing care in the home.

In the rural areas of the State particularly, the full range of social services needed for the care of chronic illness was often not available. However, in addition to joint work with voluntary organizations, there appears to be a trend toward closer collaboration among health departments, county hospitals, and welfare departments in meeting the needs of patients with chronic disease.

In recent years, nutritionists have given particular attention to group teaching for patients with diabetes or obesity. It also appears that nutrition information is increasingly being incorporated into the regular educational services

of health departments in California, with use being made of films, printed materials, and demonstrations.

This survey, in addition to bringing in the information, served an immediate educational function. It focused the attention of hundreds of public health workers throughout the State on things that were being done and things that could be done for chronic disease control.

The information compiled and presented in this report is that furnished to the consultants of the California State Department of Public

Health by the health officers and members of their staffs. It indicates, from an overall viewpoint, that health department services and activities for chronic disease control in California, while not extensive, are increasing. Although no one department is carrying out a comprehensive program for the prevention and control of chronic disease, and in some agencies little or no attention is being given to this field, the trend seems clear—a gradual reorientation of public health services to meet the needs of the chronically ill.

An Important Date



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Scheduled for early publication

Special Section on Food and Drugs

Variations in Mortality from Heart Disease

Patient Care in Proprietary Nursing Homes

Biology of Northern Mosquitoes

Microbiological Laboratory Safety

Enigmas in Gonorrhea

One of several integrated studies of physiological fluoride effects, this series of tests explored the toxic effects in animals as a basis for studies in man. The tests demonstrated that an appreciable amount of fluoride is necessary to produce deleterious effects.

Acute and Subacute Toxicity Studies of Sodium Fluoride in Animals

By NICHOLAS C. LEONE, M.D., ERVING F. GEEVER, M.D., and NEIL C. MORAN, M.D.

CURRENT knowledge of the dosage of fluoride required to produce toxic effects in man is derived principally from suicidal or accidental poisonings (1-5). Since the exact doses ingested and absorbed are unknown, interpretation of the relationship between clinico-pathological findings and dosage is difficult. The lack of reliable methods for determining minute blood fluoride levels adds to the difficulty of evaluation.

With the more widespread use of fluorides in industry, in agriculture, and in the home, there is need for additional evaluation of acute fluoride effects. Whereas some information is available concerning chronic toxicity, there is

less concerning the acute toxic effects in man and animals.

The present study was undertaken to obtain data on the acute and subacute physiological and pathological effects of intravenously and orally administered sodium fluoride in animals. It was also undertaken to determine the safe limits of intravenous administration as an aid to the study of fluoride excretion in man.

Methods

Two types of animals, dogs and mice, were used in the experiments.

The 27 dogs tested were unanesthetized mongrels of both sexes, weighing from 7 to 10 kilograms. For convenience the dogs were separated into five groups as follows:

Group 1. Five dogs were used for the determination of the acute lethal dose by continuous infusion to the point of death, using a calibrated infusion pump.

Group 2. Nine animals were given sodium fluoride in selected fractions of the acute lethal dose (with the same technique and infusion rate as in group 1) and observed for varying periods.

Group 3. Two dogs were given daily intravenous injections of sodium fluoride for 23 days.

The authors are all with the National Institutes of Health, Public Health Service. Dr. Leone is chief of Medical Investigations and Dr. Geever is pathology consultant with the National Institute of Dental Research. Dr. Moran is head of the Pharmacodynamics Section of the Laboratory of Chemical Pharmacology, National Heart Institute.

Technical assistance was given by William M. Butler, Jr., M.S., and James S. Watts, B.S., of the Laboratory of Chemical Pharmacology, and Patricia B. Geiser, M.S., Public Health Service Nurse Officer with the National Institute of Dental Research.

Table 1. Summary of fluoride effects in dogs

Dog group	Dose of fluoride ¹ mg./kg.	Rate of intravenous infusion ¹ mg./minute	Average body weight (kg.)	Number of dogs	Number of spontaneous deaths	Survival time
Group 1.....	{ 236 31	{ 5.4 1.1	8.9	{ 4 1	4 1	59-64 minutes. ³ 219 minutes. ³
Group 2.....	{ 25 20	{ 5.4 5.4	9.3	{ 3 2	3 1	1, 18, and 31 hours. 36 hours. 7 days (S). 36 hours (S).
Group 2.....	15	5.4		4	0	7 days (S). 16 days (S, 2 dogs).
Group 3.....	5	4.1	7.9	2	0	23 days (S).

¹ Doses expressed as fluoride ion. ² Mean of 4 dogs. ³ Death occurred during continuous infusion.
 * Single intravenous injection given daily for 23 days.

S=Sacrificed.

Group 4. Four animals were given sodium fluoride in single doses by mouth.

Group 5. Seven untreated dogs were sacrificed by exsanguination to provide normal control material for the pathological anatomy studies.

Under local anesthesia, the femoral artery and vein of the dogs in groups 1 and 2 were cannulated for recording arterial pressure and for intravenous infusion. Blood pressure was recorded with an Anderson glass capsule manometer (6). Respiratory rates and electrocardiograms were recorded by routine methods. In all groups, pupil size and reactivity, tendon reflexes, emesis, defecation, urination, and other significant behavioral and neurological changes in the animals were also observed. In groups 1, 2, and 4, blood was taken before and after administration of sodium fluoride for the determination of serum calcium.

The term "acute lethal dose," as used throughout, refers to that dose at which death occurred as the result of continuous intravenous infusion (group 1). The term "subacute lethal dose" arbitrarily applies to that dose of fluoride causing death one or more hours following administration (group 2).

A sterile, pyrogen-free solution of sodium fluoride (10 mg. of F ion per ml.) was used for intravenous administration; sodium fluoride powder was used for oral administration.

All doses are expressed in terms of the fluoride ion.

Necropsy was performed as soon after death as possible, in most instances immediately. Animals that did not die as a direct result of administered fluorides were sacrificed by exsanguination following sodium pentobarbital anesthesia. Necropsy was not performed on the animals that received fluoride by mouth. Tissues were fixed in 10 percent formalin for microscopic examination, and routine methods of tissue preparation, paraffin embedding, and hematoxylin and eosin stains were employed. Special fat stains using oil red O-hemalum and

Table 2. Emetic, cardiotoxic, and lethal doses of sodium fluoride during continuous intravenous infusion of group 1 dogs

Experiment dog No.	Dose ¹ at which—			Terminal ECG event
	Emesis occurred	Arrhythmias appeared	Death occurred	
1.....	19.8	29.4	36.0	Asystole.
2.....	20.8	30.7	36.6	Asystole.
3.....	20.5	33.6	36.8	VF.
4.....	17.6	28.7	34.6	VF.
Mean.....	19.7	30.6	36.0	

¹ Doses expressed as milligrams of fluoride ion per kilogram. All animals infused at a rate of 5.4 mg. per minute.

VF denotes ventricular fibrillation.

Nile blue were made on renal tissue from 7 controls and 11 fluoride-treated dogs from groups 1, 2 and 3.

For mice the oral and intravenous lethal doses (LD_{50}) were determined by using fasted, male, white mice of uniform weight (10 grams). Each dose level was evaluated in groups of 10 or more mice. The LD_{50} was calculated by the method of Litchfield and Wilcoxon (7). The arbitrary end point was 24 hours after administration.

Physiological Effects in Dogs

Group 1

Four dogs were given sodium fluoride by continuous infusion at a rate of 5.4 mg. of fluoride ion per minute to death. The mean acute lethal

dose was 36.0 ± 0.5 mg./kg. (tables 1 and 2). An additional animal was infused at a rate of 1.1 mg. per minute to a lethal dose of 31 mg./kg. but is not included in the calculation of the mean acute lethal dose because of the difference in infusion rate.

No significant change in arterial blood pressure occurred until an average dose of 15 mg./kg. was reached. Beyond this point there was a moderate decrease in pulse pressure. From 20 to 30 mg./kg. there was a moderate fall in systolic and diastolic pressure, after which a rapid, progressive fall of blood pressure occurred (fig. 1).

Little change in mean heart rate was noted at low doses; however, after 20 mg./kg. had been given, there was a progressive decline in rate to zero at death (fig. 1).

Consistent electrocardiographic changes did

Figure 1. Respiratory and cardiovascular effects of sodium fluoride administration to group 1 dogs.

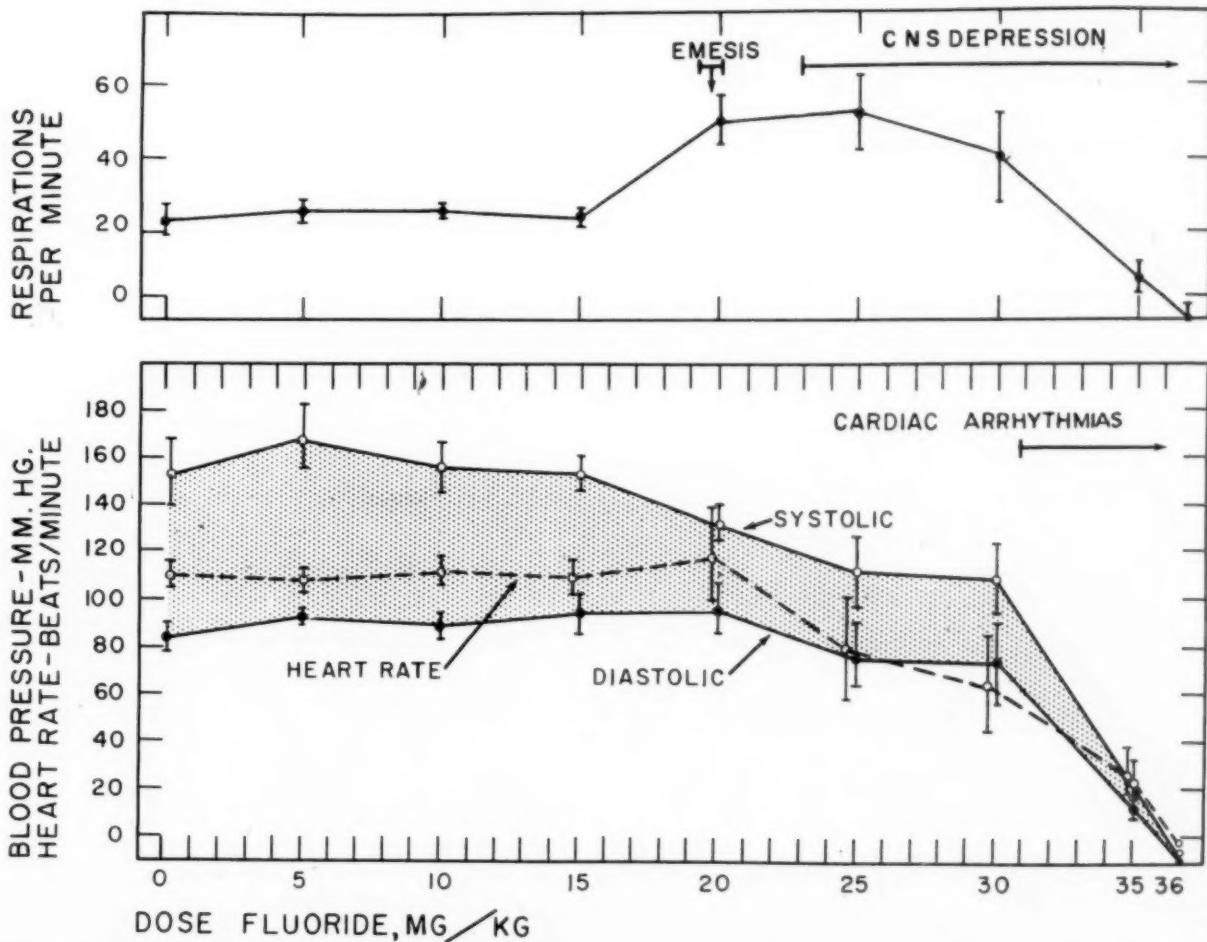
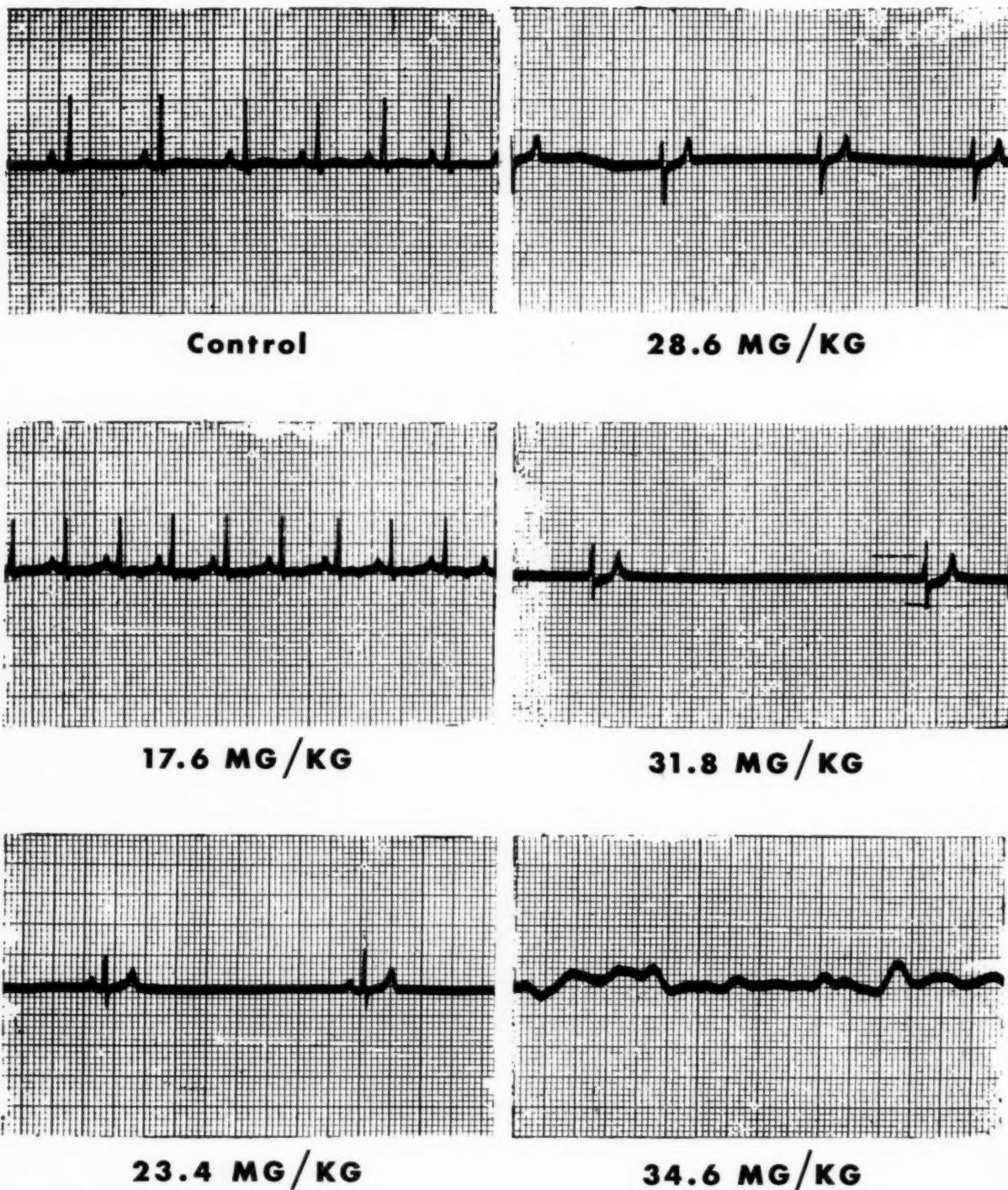


Figure 2. Electrocardiograph tracings (standard limb lead III) show the progressive effects of increasing doses of sodium fluoride on the heart of an unanesthetized dog. The rate of intravenous infusion was 5.4 milligrams of fluoride ion per minute in a 9.2 kilogram dog.



not appear until a mean dose of 30.6 mg./kg. was reached, when there was conversion in every dog to atrioventricular nodal or ventricular rhythm. The terminal cardiac event was either ventricular fibrillation or asystole (table 2). Occasional changes in the amplitude and direction of the T waves and S-T segments were noted before loss of sinus rhythm but were not consistent. Durations of PR, QRS, and QT intervals did not change until abnormal rhythms occurred. Figure 2 illustrates the electrocardiographic tracings of a representative experiment.

On necropsy the hearts were usually found in systolic contracture. When arrested in diastole, slight mechanical stimulation of the heart induced contracture.

Average respiratory rates did not change appreciably until a dose of about 20 mg./kg. was reached, when an increase occurred. From 30 mg./kg. to the lethal dose, a progressive depression of rate was observed (fig. 1) as also was amplitude. In most of the animals there were frequent short periods of tachypnea, often occurring during the phase of central nervous system depression.

Depression of the central nervous system progressing to coma appeared in all group 1 animals at doses of from 23 to 31 mg./kg. Pupil size and reflex response to light were unaffected until moderately severe central depression developed. At that stage dilation and hypoactive reflexes were noted. Terminally, maximal dilation and areflexia of the pupils occurred. The corneal reflex persisted until the period immediately prior to death. Depression of tendon reflexes paralleled the central depression. Convulsions were not observed in the animals of this group in which the infusion rate was fast. However, in the one case with a slower infusion rate, a stage of neuromuscular hyperexcitability was prominent in the dose range of from 22 to 25 mg./kg. Characteristic of this phase were hyperactive tendon reflexes with clonus, tonic convulsions, and muscle fasciculations. This stage merged into the comatoso state described in other animals.

Emesis and defecation were consistent effects with a mean emetic dose of 19.7 ± 0.8 mg./kg. (table 2). Defecation usually occurred shortly before or immediately after emesis.

Group 2

The dogs in group 2 were infused at the rate of 5.4 mg. per minute. The infusions were stopped at arbitrarily chosen fractions of the acute lethal dose of group 1 (15, 20, 25 mg./kg.), and the animals were observed until death or sacrifice.

Three dogs which received 25 mg./kg. of fluoride died within 1 to 31 hours after the end of the infusion. One of the two dogs given 20 mg./kg. died at 36 hours, while the other survived until sacrificed at 7 days. None of the four animals administered 15 mg./kg. died as a result of the fluoride. An approximate subacute lethal dose 50 (LD_{50}) of 20 mg./kg., therefore, might be assigned to fluoride when given by this method of administration. Table 1 summarizes the results in this group.

Up to the point where the infusions were stopped in the group 2 animals, the cardiovascular and respiratory effects were similar to those of group 1 (fig. 1). There were no consistent electrocardiographic changes in these animals although recordings were not obtained in the period immediately preceding death in those animals which succumbed to the fluoride.

Depression of the central nervous system began before completion of the infusion in all three dogs given 25 mg./kg. and deepened progressively until death. Similar depression was observed in the animal that died as a result of 20 mg./kg. of fluoride. All of the other group 2 animals passed through a short stage of reduced activity, but no severe depression was observed.

Emesis occurred in all of the animals that received 20 or 25 mg./kg. Two of the four dogs receiving 15 mg./kg. of fluoride vomited about 30 minutes after cessation of the infusion.

Group 3

Group 3 consisted of two dogs given fluoride by daily intravenous injections of 5 mg./kg. for 23 days. Blood pressure and respiratory rates were not recorded. The animals remained in good condition with no evidence of toxic effects or weight loss. Electrocardiographs remained normal. The results are summarized in table 1.

Group 4

The four animals in group 4 were each given a single dose of sodium fluoride by mouth in powder form. One received the compound mixed in food and the others in gelatin capsules. Doses of 38, 81, 260, and 3,100 mg./kg. of fluoride were given. The main effects observed were vomiting and frequent defecation. In one case (3,100 mg./kg.) the vomitus was grossly bloody and the animal was mildly stuporous for a short period. In every dog in this group there was apparently complete recovery in 18 to 24 hours.

Physiological Effects in Mice

The oral LD₅₀ with standard error was 46.0±1.6 mg./kg. as compared with an intravenous LD₅₀ of 23.0±0.9 mg./kg. (table 3). Mice dying within 2 hours after injection showed successively cyanosis, dilatation of ear vessels, depression of respiration, tremors, clonic convulsions, paralysis of the hind legs, loss of righting reflex, depression, respiratory arrest, and death. Those with longer survival periods (2 to 24 hours) went through similar, but less severe, stages, progressing to a long terminal depression.

Serum Calcium and Blood Clotting

The effects of fluoride on serum calcium were determined on 11 dogs (table 4). Whole blood was drawn for serum calcium determinations prior to infusion and again immediately before death in the group 1 animals. In the group 2 animals, blood was drawn prior to and at the end of infusion. Blood was drawn from 1 animal in group 4 approximately 1 hour after administration. There was a slight drop in serum calcium in 9 of 11 animals. This finding has been reported by others (3, 8, 9).

Although no clotting-time determinations were done, soft, friable, poorly contracted clots were observed in blood samples drawn after fluoride administration.

Pathological Anatomy of Dogs

The only gross pathological changes noted in dogs were generalized hyperemia in the animals

that died after fluoride administration, whether acute or delayed and, in addition, focal hemorrhages in those dogs that died from 18 to 36 hours after fluoride administration.

Table 3. Intravenous and oral lethal dose determinations of sodium fluoride in mice

Dose of fluoride ¹ mg./kg.	Ratio of deaths to mice used	Percent deaths
<i>Intravenous ²</i>		
18	0/10	0
21	3/10	30
24	7/10	70
27	9/10	90
36	10/10	100
48	10/10	100
<i>Oral ³</i>		
24	0/10	0
36	1/10	10
42	1/10	10
48	3/10	30
54	4/10	40
60	10/10	100
72	10/10	100
84	9/10	90

¹ Expressed as fluoride ion.

² Intravenous LD₅₀=23.0±0.9 mg./kg.

³ Oral LD₅₀=46.0±1.6 mg./kg.

Table 4. Effects of fluoride on serum calcium in 11 dogs

Group	Number of dogs	Dose of fluoride ¹ mg./kg.	Serum calcium mg./100 cc.	
			Prior to fluoride administration	Immediately after fluoride administration
1-----	3	² 36	8.94	7.23
			6.51	7.75
			8.00	6.70
2-----	3	² 25	11.15	9.65
			8.50	6.50
			8.60	7.20
2-----	2	² 20	10.30	10.30
			9.70	9.40
2-----	2	² 15	9.20	8.60
			9.40	8.20
4-----	1	³ 3, 100	8.50	7.90

¹ Expressed as fluoride ion.

² Intravenous administration.

³ Oral administration.

Microscopically, all animals that died after fluoride administration and one surviving until sacrificed at 36 hours showed generalized hyperemia and acute focal hemorrhages. All other animals showed some focal hyperemia and focal hemorrhages, but the conditions were no more severe than those in the control group.

Although special attention was given to brain, heart, liver, kidneys, lungs, gastrointestinal tract, and bone marrow, no other histological evidence of cellular injury could be found in any animal. Differences in fat concentration were found, but variations were as great among the controls as among the animals exposed to fluoride. The fat appeared to be liberated from the cytoplasm of the tubular epithelium, particularly along the cortico-medullary junction.

Incidental findings, common to the treated and the control dogs, included roundworm and tapeworm infestation of the intestinal tract and microscopic acute and chronic nonspecific inflammation of the lungs, kidneys, liver, and, less often, of the myocardium.

Discussion

On the basis of the present study several points stand out in regard to the acute toxicity of sodium fluoride in dogs.

First, the doses of intravenously administered fluoride required to produce acute toxic effects in animals are high, and there is no evidence of cumulative effects on daily administration of sublethal doses for a period of 3 weeks.

Second, the more uniform effects with a constant rate of intravenous infusion of sodium fluoride are in contrast to the more erratic results and difficulty in producing toxic effects with oral administration.

Third, the physiological effects and pathological changes seen in dogs given toxic doses of fluoride resemble those reported in human fluoride poisoning (1-4).

The greater uniformity of results seen in groups 1 and 2 on intravenous administration is most evident in the relatively precise doses at which the various physiological effects occur. In contrast, the erratic results observed when fluoride is given to dogs by mouth are largely

due to the loss of undetermined amounts of the administered dose through vomiting.

Diarrhea and bloody stools were observed in some animals in which death was delayed from 1 to 36 hours. Similar findings have been reported in human cases (1, 3, 4).

The vasodepressor action of fluoride seen in this study has been demonstrated by Greenwood and associates (10). It probably is due to a combined depression of the vasomotor centers of the brain and of the vascular smooth muscle. The cardiac arrhythmias, resembling those resulting from high serum potassium, are probably caused by enhanced sensitivity of the myocardium to potassium, secondary to decreased serum calcium concentration. The terminal systolic contracture is of particular interest in view of Loewi's recent observations of a positive inotropic effect of sodium fluoride on the depressed frog heart (11). He suggests this action is caused by the formation of a complex of fluoride, a cellular constituent and calcium, and that this complex restores the cellular membrane excitability to normal. However, no conclusive evidence is available to suggest a comparable action in mammalian hearts.

The central nervous system and neuromuscular effects of sodium fluoride may be related to two actions: one, a reduction of ionizable calcium through a fluoride binding effect, resulting in a state of neuromuscular hyperexcitability, that is hypocalcemic tetany, and, second, a depression of the central nervous system as a possible result of enzyme inhibition (12).

Routine pathological studies did not demonstrate a specific mechanism of death in experimental fluoride exposure, but at the levels used in this study, and with the short interval to death in many instances, direct toxic cellular effects cannot be ruled out despite the lack of histological evidence of injury. The gross and microscopic pathological examination showed only generalized congestion and acute focal hemorrhages. Similar changes in man and animals have been described for deaths due to fluoride poisoning (1, 4, 13, 14). These changes are interpreted as resulting from injury to vascular endothelium.

Fatty changes have been described in the

tubular epithelium of rat kidneys following prolonged administration of sodium fluoride (15). In our dogs, shift of renal fat was noted, but no consistent pattern could be found on comparison with the normal controls.

Reviewing the results of this study, it is interesting to compare the findings in animals with human cases of fluoride poisoning (1-4). Outstanding is the study of Lidbeck, Hill, and Beeman, who reported a mass accidental poisoning of 263 persons with 47 fatalities (1). They described respiratory and cardiovascular depression as a common finding in addition to a number of other manifestations also observed in the present study. An example is: "General collapse developed in most instances but at variable periods of time, apparently depending upon the concentration of the poison. This was characterized by pallor, weakness, absent or thready pulse, shallow, unlaborated respiration, weak heart tones, wet cold skin, cyanosis, and equally dilated pupils. When this picture was pronounced, death almost invariably occurred." This description closely follows the findings in our animals receiving a fatal dose of fluoride.

In the present study and the clinical cases described by Lidbeck and associates, convulsions were not regularly observed. However, the carpopedal spasm and spasm of the extremities, described by these authors in a few patients who recovered or where death was delayed, resembled the neuromuscular hyperexcitability seen in one dog in the present study. These effects may be manifestations of hypocalcemic tetany. Generalized convulsions which have been described by others could be on the basis of cerebral anoxia or severe hypocalcemia (2).

On a practical basis, the data from this study may be of value in the evaluation and treatment of cases of acute fluoride poisoning in man. For instance, electrocardiographic demonstration of a cardiac arrhythmia in the absence of known heart disease would suggest that about three-quarters of the acute lethal dose had been absorbed and would imply poor prognosis. Central nervous system depression to a marked degree might also denote the absorption of more than half of a lethal dose.

The intravenous lethal dose of fluoride determined in the present study agrees well with

those previously reported if differences in injection rates and in species are considered (10, 16, 17).

This information, establishing the relatively high dosage of fluoride required to produce acute toxic effects in animals, suggests that small intravenous doses may be used with safety for human studies. The absence of toxic effects in dogs given 5 mg./kg. of fluoride intravenously daily for 3 weeks also suggests a considerable margin of safety and an apparent absence of accumulative toxic effects in this period of time.

Summary

In this limited study, designed to evaluate the acute toxic effects of sodium fluoride in dogs and mice, it was demonstrated that:

1. The mean acute lethal dose of sodium fluoride in unanesthetized dogs infused to death by continuous intravenous infusion at the rate of 5.4 mg. of fluoride ion per minute was 36.0 ± 0.5 mg./kg. The principal effects were progressive depression of blood pressure, heart rate, and central nervous system with vomiting and defecation, all occurring with the administration of approximately 20 mg./kg. At a mean dose of 30.6 mg./kg. there was a depression of respiratory rate and a conversion to atrioventricular nodal or ventricular rhythm with terminal ventricular fibrillation or asystole.

2. In a group of dogs infused intravenously with selected fractions of the acute lethal dose, an approximate LD_{50} was estimated to be 20 mg./kg. The major effects observed in this group were vomiting, defecation, and central nervous system depression. In the fatal cases death occurred in 1 to 36 hours.

3. In a group of dogs given 5 mg./kg. intravenous injections daily for 23 consecutive days, no toxic effects were observed.

4. In dogs, single doses up to 3,100 mg./kg. of fluoride by mouth produced only vomiting, defecation, and transient moderate depression.

5. The intravenous LD_{50} in mice was 23.0 ± 0.9 mg./kg. and the oral LD_{50} , 46.0 ± 1.6 mg./kg.

6. A slight drop in serum calcium followed the infusion of fluoride in most dogs in which serum calcium was determined.

7. The pathological findings in those animals which died directly as a result of sodium fluoride administration consisted of generalized hyperemia and acute focal hemorrhages.

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Inventory of Water Needs

At least one of every four large urban areas have reported they need additional water supplies to meet anticipated municipal and industrial growth, according to a nationwide inventory taken by the Water Supply and Water Pollution Control Program of the Public Health Service.

Of 1,532 community water facilities, 367 serving a population of nearly 20 million need additional water supplies. About one-fourth of the water supply facilities need additional distribution systems, partly because of the growing practice among municipalities to provide water service to suburban areas. More than half of the facilities need improvement or enlargement.

The inventory covered all facilities serving 10,000 people or more and a 40-percent sample of facilities serving between 5,000 and 10,000 people. It lists population served, source of supply, treatment provided, capacity, storage, and the improvements which local officials consider necessary to maintain satisfactory service. Additional details are available from the Water Supply and Water Pollution Control Program, Public Health Service, Washington 25, D. C.

Accident Prevention In Sanitation

By EDGAR F. SEAGLE, M.S.P.H.

THE ESSENTIAL points of this paper have been used to introduce to local health department personnel in North Carolina the close relationship between good sanitation practice and accident prevention. This concept of sanitation, though obvious in principle, seems to be difficult for many health workers to visualize in specific terms. The following examples, presented at State and local health staff conferences, appear to have improved acceptance and understanding of this concept and to have advanced and encouraged its many applications, with good results for sanitation all around.

A change of concepts has been characteristic of the progress of sanitation services. For example, not too many years ago sanitarians dressed like policemen and worked principally on the basis of enforcing laws which neither they nor their clients thoroughly understood. Sanitarians today dress like teachers or salesmen, and they work primarily to promote sanitation on its own merits, with a foundation of public acceptance, understanding, and approval. The word sanitation itself illustrates how concepts have changed. For many years, it has been associated primarily with cleanliness. But its original meaning was the protection of health; and that original meaning is restored to the extent that sanitarians broaden their responsibility and understanding.

Accident prevention is one program for protecting health which forces sanitarians to look

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beyond details of neatness and cleanliness toward the true objectives of their work. At the same time, accident prevention enjoys much broader public understanding and acceptance than the processes of preventing contamination of food by invisible microbes. It is not only within full ken of human experience, but it also appeals directly to self-interest. Everyone is certain to be more concerned with a possible accident to themselves than with the uncertain and indirect effects of his habits on others.

Control of Hazards

To illustrate how accident prevention can play an important role in the improvement of sanitation, consider first the food handler working in the kitchen of a restaurant. If this person has an open cut or wound on his hand while preparing certain foods, the potential for contaminating this food with infectious bacteria is certainly high. Of course, if this person has been well schooled in proper food handling, he would not work with an open cut, but how many are so trained? The safe approach is to prevent such an accidental cut if possible. In one instance, every time a food handler reached for a certain pan he either scratched or cut his hand on a sharp edge of metal on the side of the storage cabinet. If this environmental hazard had been corrected, the food handler would not have had so many cuts. At the same time, his potential of food contamination would have been less. The manager might be induced to correct such conditions more readily if the element of personal pain and suffering, as well as liability for workman's compensation, had been discussed along with the food infection hazard. This approach also gives a client the feeling that you are interested in him personally and helps to secure cooperation.

Sanitarians have long been concerned with the cleanliness of floor and wall surfaces. To maintain cleanliness they should be made of smooth, washable, nonabsorbent material, free from cracks, crevices, and open joints. Such a surface certainly is a poor place for germs to

take a foothold. It also, however, contributes to safe walking and movement on the premises. The fact that floor surfaces, if properly constructed, contribute not only to cleanliness but to safety is another example of how accident prevention can strengthen a sanitation program. It also illustrates that sanitarians have been engaged in accident prevention often without directly realizing what they have achieved.

Restaurant and meat market regulations usually require adequate lighting and ventilation. Here again these regulations were primarily set up in the interest of cleanliness; that is, if you can see dirt, you can clean it up. Another important advantage in good lighting though is to reduce accidents. Poorly lit cellars or stairs need no comment: Their high potential as a source of falls resulting in disabilities and death is too well known. Good lighting is certainly needed to see that equipment is effectively washed and cleaned. However, good lighting at the cutting, mixing, or grinding table in the kitchen may prevent a slash to a finger or hand. Many a hand is caught in a piece of equipment because the moving parts are not clearly seen in a dim light. Here again, the accident prevention concept for the operator or foodhandler is a strong supplement to sanitation.

Garbage cans also may figure in preventing accidents. For example, many garbage cans of food-handling establishments sit on back platforms, to be emptied daily. When there are enough cans, there is less spilling refuse and other wastes and the walking area is more likely to be dry and clear. However, if garbage cans overflow, meat scraps, bones, rubbish, offal, filth and other wastes are strewn over the back platforms and eventually are kicked or carried into the kitchen. Articles of this kind provide a slippery underfooting and may provoke a bad spill or fall as much as a broom or other heavy litter in the walking area. Therefore, walkways clear of garbage discourage breeding of flies, rodents, and germs, but also discourage the chances of accidental falls.

It is recommended that merchandise in the storage room be stored on elevated platforms to facilitate cleaning. If this recommendation is carried out, things are certain to be more in order than if they are strewn on the floor at

random. Here also, the possibility of tripping and falling is reduced. Again, neatness and accident prevention join in the common cause of sanitation.

Farm Sanitation

Examples of sanitation improvement by eliminating accident producing environmental conditions can be found also on farms and in dairies. Uncovered holes or slick surfaces on graded levels around the barn may result in cows slipping and injuring their udders. Such injuries in turn may produce mastitis. Mastitis means not only an economic loss to the farmer but may also mean a possible danger of infection in the milk. However, an employee or the farmer himself may fall and break a leg in these same danger spots. Therefore, if farm sanitation work is done with an eye towards protecting the farmer as well as the cow from accident, both may benefit. Such hazards are typified also by discarded pit privies. If these are effectively filled in, there is less possibility of spreading disease; however, the fill also reduces the chances for an accident. Discarded wells also should be filled in or securely covered, for similar reasons.

As to insect and rodent control, the North Carolina State Board of Health is pursuing a project which although designed primarily to prevent mosquito breeding also prevents many home accidents. This project is that of inspecting every home and farm pond and stressing that all tree stumps and other obstructions be completely cleared from the pond bed. The regulation calls only for these stumps to be a certain number of inches below the fluctuating water level. However, sanitarians strongly recommend complete clearing of the pond bed. They then accomplish both the primary purpose and also eliminate the chance that swimmers diving in the pond may hit their heads on these obstructions, as well as the threat to boats on the larger ponds. If a farmer is reluctant to believe that these stumps have any important relation to mosquito breeding, he may be more readily convinced that some member of his family can be seriously injured or killed if the stumps remain.

There are many other examples of the close relationship between accident prevention and other phases of sanitation.

In North Carolina, studies have shown that there were 825 accidental deaths in 1954 on the farm and in the home. This is a rate of approximately 2 deaths per day. It has been estimated that for each of these fatal accidents, there are 150 accidental injuries resulting in disability for 24 hours or longer, and 4 of these are permanent disabilities. Any accident prevention activity should be preceded by an in-service training program for sanitarians and a

check list of home hazards agreed upon and approved. Armed with this knowledge, the sanitarian could then discuss such situations on the spot and make recommendations for the most practical means of elimination or correction. Such a program may be used by all categories of public health personnel who visit the public in their daily duties. Accidents are unquestionably one of the major health problems. Sanitation personnel have a great opportunity to combine accident prevention activities with their existing programs. Such a forceful combination would add even greater satisfaction to their present valuable work.

Galactosemia Cause Found

The cause of galactosemia, also known as galactose diabetes, an often fatal metabolic disease of children, has been discovered by scientists of the National Institute of Arthritis and Metabolic Diseases, Public Health Service. It was reported in official announcements on March 12, 1956.

This disease ordinarily appears within a few days after birth. The infant suffering from galactosemia is unable to utilize or even tolerate milk in any form. Lactose, often called milk sugar, contains another sugar, galactose. This substance cannot be handled by the child's system if he has galactosemia.

Drs. Herman M. Kalckar, Elizabeth P. Anderson, and Kurt J. Isselbacher at the National Institutes of Health discovered a hitherto unknown enzyme in normal red blood cells, which they call P-Gal transferase. This enzyme, they found, is necessary to complete conversion in the body of galactose into glucose, the common sugar of the blood.

Diagnosis of galactosemia is difficult because the symptoms are similar to those of other disorders. Diarrhea, lack of appetite, loss of weight, and jaundice appear in the earlier stages. In later stages, the disease leads to cirrhosis of the liver, mental retardation, blindness due to cataract, and death.

Early recognition of galactosemia is highly important, since the disease progresses rapidly, leaving serious irreversible changes. When diagnosed in an early stage, treatment is simple. The affected child, placed promptly on a milk-free diet, will grow and develop normally.

The discovery of P-Gal transferase promises to provide a rather simple diagnostic test, making earlier life-saving treatment possible. It also points the way to exploration of the possibility that impairment of galactose metabolism may be a factor in other disorders of unknown origin.

The model poultry ordinance as it now stands deals only with the general enforcement and sanitary provisions. A part dealing with inspection is to come.

Development of a Poultry Ordinance

By JOE W. ATKINSON, D.V.M.

THE Public Health Service has developed a model poultry ordinance for voluntary consideration by State and local agencies which are conducting or planning inspection and sanitation activities regulating the processing, storage, transportation, and sale of poultry and poultry products. Why and how was the ordinance developed? What is its potential value?

Background

The poultry industry has doubled in size since 1940. In 1953, it was the third largest source of gross farm income, representing 12.1 percent of the total. The value of poultry and poultry products, including eggs, was almost \$4 billion at the farm level and \$6 billion at the retail level. Per capita consumption of poultry meat reached 34.4 pounds.

A radical change in buying habits and merchandising methods has accompanied this tremendous growth. The consumer seldom sees the live bird to evaluate its health. Processing has progressed from on-the-spot slaughter, observed by the customer, to production line methods. The product may be stored for ex-

tended periods, shipped long distances, and consumed far from the point of origin. This mass processing and distribution has presented new problems in meeting standards of consumer expectancy and of public health.

Diseased Poultry

Noteworthy progress has been made in the prevention and treatment of poultry diseases, yet a substantial number of diseased birds are marketed. Entire flocks may be sent to slaughter in an attempt at salvage when disease outbreaks appear. The production of large commercial flocks in crowded facilities and concentrated areas heighten the possibility of the dissemination of disease, as shown currently by the high rate of respiratory diseases in areas of concentrated broiler production. The number of pounds of poultry condemned by the Poultry Inspection Branch, Department of Agriculture, as unfit for human consumption ranged from 4,075,121 in 1951 to 6,960,529 in 1954 (table 1).

In the poultry processing industry, as in other industries, the advent of mass production operations has brought increased occupational health problems. During recent years, scattered outbreaks of psittacosis among employees of poultry-processing establishments emphasized the necessity for adequate ante-mortem and post-mortem inspection of poultry, high standards of sanitation, and special protective measures in reducing possibilities of employees' becoming infected while at work. A transmissible disease may assume increased public

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Table 1. Summary of post-mortem examination of poultry, Department of Agriculture, 1951-1954¹

Item	1951	1952	1953	1954				
	Number of plants under inspection							
	189 (Oct. 15)	221 (Oct. 13)	235 (Oct. 1)	257 (Oct. 1)				
Weight (pounds):								
Inspected.....	694, 530, 135	902, 907, 357	1, 003, 841, 374	1, 139, 703, 950				
Certified.....	690, 455, 014	897, 141, 239	997, 811, 515	1, 132, 743, 421				
Condemned.....	4, 075, 121	5, 766, 118	6, 029, 859	6, 960, 529				
Percent condemned.....	.58	.639	.60	.61				
Carcasses condemned								
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Tuberculosis.....	241, 417	19. 97	266, 910	17. 043	230, 777	12. 52	177, 291	9. 24
Emaciation.....	37, 054	3. 07	45, 561	2. 909	43, 840	2. 38	29, 938	1. 55
Septicemia and toxemia.....	290, 550	24. 03	400, 610	25. 581	573, 591	31. 11	634, 386	32. 97
Leucosis.....	138, 114	11. 42	167, 786	10. 714	152, 046	8. 25	154, 923	8. 05
Tumors.....	101, 792	8. 42	123, 011	7. 854	96, 323	5. 23	122, 202	6. 35
Inflammatory processes.....	200, 194	16. 56	329, 953	21. 069	524, 547	28. 45	591, 270	30. 73
Parasites.....	1, 409	.12	3, 976	.254	2, 385	.13	1, 450	.08
Gout.....	803	.07	1, 626	.104	2, 065	.11	777	.04
Bruises.....	42, 238	3. 50	54, 637	3. 489	62, 056	3. 37	56, 068	2. 91
Contamination.....	37, 994	3. 14	58, 297	3. 723	53, 587	2. 91	60, 622	3. 15
Decomposition.....	87, 100	7. 21	65, 633	4. 191	33, 637	1. 82	24, 481	1. 27
Cadaver.....	13, 031	1. 08	24, 748	1. 580	34, 132	1. 85	34, 808	1. 81
Overscald.....	11, 256	.93	12, 457	.795	17, 820	.97	13, 136	.68
Other causes.....	5, 825	.48	10, 872	.694	16, 640	.90	22, 596	1. 17
Total.....	1, 208, 777	100. 00	1, 566, 067	100. 000	1, 843, 446	100. 00	1, 923, 948	100. 00

¹ Adapted from annual summaries prepared by the Poultry Division, Agricultural Marketing Service.

health significance through a previously unknown strain of the infective organism, through the adaptation of a known strain into a form more highly virulent to man, or through certain conditions which enhance the transmissibility of the disease from the animal host to man or from man to animal (1).

Insanitary Conditions

The 1950 annual report of the Food and Drug Administration stated: "In the meat and poultry projects, major attention from a filth standpoint was given to poultry that was decomposed or contaminated by fecal matter in washing and scalding tanks."

Quoting from the report for 1951: "Poultry ranks third in the number of filth and decomposition charges. When meat prices increased, many inexperienced operators entered the field of poultry production. More than three times as many seizures of unfit birds were made as in the previous year. The main causes of com-

plaints were contamination by fecal matter, preparation under unsanitary conditions and diseased, improperly dressed birds."

And the 1952 report said: "There was continued pressure to improve the sanitary handling of poultry in dressing plants and eliminate traffic in diseased birds. Plants visited ranged from "pot scalders" to assembly line establishments dressing 600,000 pounds of broilers in a 24-hour day. Conditions varied from excellent to repulsive, regardless of size or type of equipment. About 200,000 pounds were seized."

Foodborne Outbreaks

The types of *Salmonella* that frequently cause foodborne illness in man are commonly found in poultry. Furthermore, although in many instances the poultry probably is not the original source of the organisms, processed poultry, poultry products, or poultry dishes, such as pies, salads, "dinners," are frequently contaminated with Arizona paracolons, staphy-

lococci, or other organisms associated with food-borne outbreaks.

Feig's analysis of food infections and food poisonings in man shows poultry to be one of the common vehicles incriminated in food-borne outbreaks caused by food other than milk (2). Of such foodborne outbreaks reported by the States to the Public Health Service, the percentage of cases associated with poultry and poultry dishes has been relatively high since 1945 (table 2).

Dauer stated in his summary of disease outbreaks (3): "Poultry and eggs were far more important than milk or water as sources or vehicles of infection. . . . These reports very clearly indicate that fowls and eggs constitute a large reservoir of infection, and they emphasize the need for more effective methods to prevent transmission of infection to man." In the 1953 summary (4), Dauer and Sylvester reported that in one-third of the outbreaks caused by *Salmonella*, chicken or turkey was found to be the vehicle of infection. Of the total of 209 waterborne and foodborne outbreaks, involving 10,730 cases reported by the States in 1953, 65 outbreaks (31.1 percent), involving 4,696 of the cases (43.7 percent), were associated with poultry. These percentages are based on reports from the National Office of Vital Statistics.

In foodborne outbreaks, epidemiological studies are often incomplete. Yet, it has been shown from the number of cases reported that, unless adequate preventive measures are continuously effected, poultry or poultry products may serve as a source or vehicle of infection (5-7). For this as well as for other reasons, health authorities have recognized the need for poultry inspection services and for adequate sanitation and refrigeration in the processing and subsequent handling of poultry and poultry products (8, 9).

State and Local Problems

The Food and Drug Administration regularly examines poultry shipped interstate and inspects the plants of origin. Furthermore, approximately 25 percent of the poultry processed in this country originates in establishments voluntarily operating under the poultry

inspection service of the Department of Agriculture. Nevertheless, it is estimated that approximately 70 percent of the poultry processed is not inspected by either the FDA or the Department of Agriculture. This is due, in part, to limitations on funds available for the purpose under the FDA programs and to the fact that inspection by the Department of Agriculture is not mandatory for all poultry shipped interstate. Furthermore, more than half of the poultry consumed in the United States is sold within the States in which it is processed and is not necessarily subject to these Federal programs.

Consequently, extensive problems remain for State or local control. Some jurisdictions have recently revised or adopted regulations. In a few instances, the mere variety of proposed regulations has threatened the industry with trade barriers. Other jurisdictions are aware of the need for uniform action and have requested guidance, including a suggested ordinance, from the Public Health Service. Added to these requests from health officials were the recommendations in 1952 of the Conference of State and Territorial Health Officers and of the United States Livestock Sanitary Association that a model ordinance be developed to aid the States in strengthening their poultry sanit-

Table 2. Number and percentage of cases associated with poultry and poultry dishes from total of cases in foodborne outbreaks (attributed to all foods other than milk and milk products)¹

Year	Total cases reported	Associated with poultry	
		Number	Percent of total
10-year total	97,485	31,832	32.6
1945	11,465	1,994	16.5
1946	11,702	5,039	43.0
1947	11,218	3,229	28.7
1948	9,127	2,682	29.3
1949	8,237	2,843	34.5
1950	10,096	2,581	25.5
1951	7,194	2,995	41.6
1952	6,828	3,150	46.1
1953	9,914	4,696	47.3
1954	11,704	2,623	22.4

¹ As reported by the States to the Public Health Service.

tion programs. That same year the Institute of American Poultry Industries offered to assist the Public Health Service in the development of such an ordinance.

The Ordinance

The Public Health Service poultry ordinance has been developed as a joint project of the Milk and Food Program, Division of Sanitary Engineering Services, in Washington and the Veterinary Section, Epidemiology Branch, Communicable Disease Center, in Atlanta.

Field studies were conducted, and existing State and local regulations and programs were reviewed. Following completion of a first study draft of the general enforcement and sanitation provisions of the ordinance, a Public Health-Poultry Industry Liaison Committee has acted as an advisory group in its further development. This liaison committee is composed of seven members from the Public Health Service and State and municipal health departments and an equal number of members from the Institute of American Poultry Industries. The committee outlined three broad objectives:

1. Poultry should be handled only in clean establishments in a clean manner.
2. Only wholesome poultry should be offered to the consumer.
3. All trade barriers not based on sound public health principles should be avoided.

A study draft of the general enforcement and sanitation provisions of the ordinance was distributed for review and comment to major organizations of the poultry industry, to State and local agencies, and to many National organizations composed of health officials or related professional personnel.

Representatives of the Department of Agriculture, the Food and Drug Administration, and the Department of Defense were consulted at frequent intervals. They reviewed the study drafts and offered many helpful suggestions for revisions. Substantial agreement was reached on all general enforcement and sanitation requirements of the ordinance, and they were published in April 1955 as the Poultry Ordinance, 1955 edition (Public Health Service Publication No. 444).

Provisions dealing with ante-mortem and post-mortem inspection of poultry have been developed in draft form and submitted in a similar manner to the industry and to many interested agencies and groups for review and comment. These provisions are to be completed during this fiscal year.

Basis of Provisions

The provisions of the ordinance are based on the following considerations:

1. Diseased poultry may be a source or reservoir of diseases transmissible to man, including salmonellosis, erysipelas (causing erysipeloid in man), Newcastle disease, psittacosis, and various dermatoses.
2. Body discharges and dust from live poultry may be a source of pathogenic organisms, including those of the colon and paracolon types.
3. Insects may contaminate foods with etiological agents which may cause diseases such as typhoid fever, bacillary dysentery, and paratyphoid fever.
4. Rodents may contaminate water and food with hair, feces, and urine. Particularly noteworthy is the fact that *Leptospira icterohaemorrhagiae* excreted in the urine of wild rats has been reported as a principal cause of leptospiral infections in man. Rodents may be carriers of salmonellosis, lymphocytic choriomeningitis, tapeworms, and protozoans.
5. Poultry-processing wastes contain those organisms found in the body discharges of poultry, such as the *Salmonella* and other colon and paracolon types.
6. Sewage, if not properly disposed of, may be a direct or indirect source of contamination of foods with pathogenic organisms causing such diseases as bacillary dysentery, typhoid fever, and paratyphoid fever.
7. Water and ice not known to be safe may contain those species of organisms which cause such diseases as bacillary dysentery, leptospirosis, typhoid fever, and paratyphoid fever.
8. Infected employees may transmit diseases directly to fellow employees. They may contaminate foods with the causative organisms of such diseases as bacillary dysentery, salmonellosis, typhoid fever, paratyphoid fever, tuberculosis, and staphylococcal and streptococcal infections.

9. Extraneous materials in foods may cause physical injury to the consumer or be a source of contamination; rodenticides, insecticides, and various chemicals may be poisonous to man if consumed.

10. Proper refrigeration is necessary to prevent growth of micro-organisms and production of toxins in poultry and poultry products.

11. Food products offered for sale should be plainly identified and labeled with no misrepresentation.

12. The standards of consumer expectancy for foods, have, in effect, been delineated by Congress in the definitions of adulteration and misbranding as contained in the Federal Food, Drug, and Cosmetic Act; whether at the Federal, State, or local level, food-control regulations should be designed to obtain compliance with these standards.

Potential Values

The full value of the Public Health Service poultry ordinance will not be determined until it has been adopted, or at least used as a guide, by several State or local agencies as a basis for their poultry regulatory programs.

Experience in State and local milk sanitation activities has shown that the value of regulatory programs affecting food is greatly improved by a uniformity, within many jurisdictions, of requirements and enforcement procedures. This is not an interstate problem only. Uniformity of regulations and acceptance of products between local jurisdictions within a State can often be just as important to those concerned as is the case with products shipped from one State to another. There is ample reason to believe that adequate, uniform poultry regulatory programs will be of benefit to the poultry industry, the consumers, and the enforcement agencies concerned.

Such uniform programs will assist the industry in maintaining the gains of recent years and in making further progress through wide distribution of an ever greater variety of products. They will help to assure acceptance of products by the regulatory officials and by the consumers of other jurisdictions, making possible the competition which is essential for an expanding industry.

Industry members will be relieved of the ex-

pense and uncertainty of attempting to conform to conflicting requirements within the various jurisdictions where they may wish to distribute their products and will profit from increased sales in the communities where all poultry and poultry products offered for sale are consistently of high sanitary quality.

Employees' increased pride in their duties and their place of employment will contribute to increased efficiency and better products, resulting in better public relations. There will be less employee turnover, and the expense of training inexperienced personnel will be reduced.

Consumers in affected jurisdictions will receive the inestimable benefit of improved health protection and the assurance that products purchased meet standards of consumer expectancy. They will buy and enjoy with confidence the poultry and poultry products offered for sale in their community. While traveling on business or vacation trips through other jurisdictions having comparable requirements and enforcement procedures, they will have similar confidence in the wholesomeness of poultry dishes served to them en route.

It is significant, also, that uniform regulations and acceptance of products from other jurisdictions contribute to the variety of nutritious and appetizing foods available at competitive prices. Such variety and prices are directly essential to the health and happiness of the average consumer.

Regulatory agencies will benefit from the active cooperation of the poultry industry. This cooperation will be forthcoming only when the regulations are uniform, reasonable, and consistently enforced.

Widespread uniformity of regulations will help resolve the difficult, and sometimes costly, problems which face the regulatory agency in deciding whether to permit the sale of food products from other jurisdictions.

These safeguards for the health and interest of employees and consumers will be recognized and will result in respect and support of the regulatory agencies.

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technical publications

VD Fact Sheet

Public Health Service Publication No. 341. December 1955. 21 pages; 15 tables.

Basic statistics on various aspects of the venereal disease control problem have been compiled to provide a handy source of information for those persons interested in public health and venereal disease problems.

In tabular form are estimated annual costs of uncontrolled syphilis, reported mortality and insanity due to syphilis in continental United States, and cases of syphilis and gonorrhea reported to the Public Health Service. Analysis of syphilis morbidity by age, results of penicillin therapy in the treatment of congenital syphilis and secondary syphilis as well as results of health department case-finding activities are also included.

Explanatory text accompanies the tables. Information is current as of the date of publication and supersedes any previously published data.

The Child With Rheumatic Fever

Children's Bureau Folder No. 42. 1955. 13 pages. 10 cents.

The most recent folder in the Children's Bureau series, addressed to

parents and covering conditions that cripple, or may cripple children, emphasizes the preventive value of early diagnosis and treatment of a strep throat—a condition which usually precedes an attack of rheumatic fever. It describes the role played by such medicines as penicillin and the sulfa drugs in combating the infection.

Only a doctor can determine when a child has a strep throat, the folder points out. Listed are signs the parents should call to the doctor's attention.

The folder covers the care of the child who already has rheumatic fever and makes suggestions that will help in keeping him content during the important, and often lengthy, convalescent period.

Reading on Cancer. An Annotated Bibliography

Public Health Service Publication No. 457. 1955. 16 pages. 15 cents.

Books, pamphlets, reports, and articles in popular periodicals and professional journals are included in this 1955 bibliography on cancer, prepared by members of the Cancer Reports Section of the National Cancer Institute. Major emphasis is given to information from nontechnical sources, and, for the most part,

the references are not more than 5 years old. Only material in the English language is included.

A section entitled "Related Reading" lists references on such subjects as atomic energy, medical research, popular science, and science-health career opportunities. There are also references in the field of geriatrics, preventive and psychosomatic medicine, and medical history and biography. After each entry, the letter "E," "M," or "D" appears in parentheses showing whether the material is "easy reading," "moderately difficult," or "difficult." All the entries are annotated, and a topical index is included.

Booklists provide bibliographies of professional material for detailed study of specific aspects of cancer, and sources of cancer information are given.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

Organized efforts to increase group enrollment in health insurance in four communities in a western North Carolina county produced impressive results, especially with farmers and low-income rural families.

Extending Voluntary Health Insurance Through Community Organization

By DONALD G. HAY, Ph.D., and SELZ C. MAYO, Ph.D.

EXISTING GROUPS can be of major help in extending programs for prepayment of health care costs, and this paper reports how community organization functioned to promote health insurance enrollment in one rural area.

In 1951, group enrollment in health insurance was a specific activity of the Haywood County (N. C.) Community Development Program. Most organized communities in Haywood County are of the open-country type, and the area here reported includes four such localities (1), each known locally as a community. Sociologically, these localities are more "neighborhood" than "community" in character since none has a population center with a complete set of trade and other services. The communities have very few special interest organizations

other than churches and a home demonstration club sponsored by the agricultural extension service.

Community Organization

In 1949, the agricultural extension service, in cooperation with other professional workers, began a program in Haywood County through which the local residents of each open-country community would undertake a community development program. Because there were few special interest organizations in these communities, coordination of activities was not a problem.

The organizational structure created to carry out the development program is known locally as the community club. The community club performs the major functions of study and planning and directs specific actions within the community. In the literature dealing with community organization, this type of organizational structure is classified as a form of the direct type of community organization.

Each of the four locality groups in the study contained a community club. In 1954, these clubs carried out their development programs through the following officers and committees:

1. Chairman, vice chairman, secretary, treasurer, and reporter. These officers were elected at regular, communitywide meetings.

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2. Six standing committees: survey, planning, program, recreation, refreshment, and scrapbook.

3. Special committees appointed to develop particular farm production enterprises for the community: tobacco, corn, hay, pasture, beef, dairy, and poultry.

4. Other committees designed to promote development of health, foods and nutrition, roads, and youth activities.

A study (2) was made of the organizational structure, operational procedures, and programs of one of these communities. Regular communitywide meetings are held each month in the educational wing of a local church. One of the most pressing needs, consequently one of the goals for 1954, was construction of a new center to be used for meetings and other community activities and to aid in the development of educational work in the community. A special committee was charged with this responsibility.

Each community meeting opens with devotions. A business session follows, during which plans are made, new programs are adopted, and committee reports are presented. Next there is an educational program, which may be centered on agricultural practices, international relations, such as a film on rural life in India, or explanations of a voluntary health insurance plan. The meeting closes with a recreation and refreshment period, which may include community singing and a supper or light refreshments.

One of the first steps in each community during the period of creating the community club was to identify the community boundaries. When this decision had been reached by the original interested group, community identification signs were erected on each road or highway running through the community. These signs circumscribe the community and, in a highly organized county, virtually every family is a member of the community "in-group," as determined by these boundaries. It is particularly necessary to emphasize the importance of this operational procedure since it is through this means that the identity of the "group" is determined for the voluntary health insurance program.

There are no dues and no membership rolls

for the community meetings; the number of families in the in-group is determined by community boundaries, not by the number of families whose members attend the meetings. To aid in understanding the actual operation of the voluntary health insurance program of the communities, one other aspect of the organizational structure in Haywood County must be noted in some detail, the county organization of the community development program.

The county organization was designed to coordinate and promote the activities of the community clubs throughout the county. In 1954, this work was carried out through the following officers, directors, and commissions operating under the name of the Haywood County Community Development Program:

County Officers. Chairman, vice chairman, reporter, secretary, and treasurer. County officers were elected from among community officers and members.

Board of Directors. Chairman, vice chairman, secretary, treasurer, and eight regular members. Both men and women were included. This group was responsible for developing policy and administering the community development program on the county level.

County Planning Commissions. County commissions were established in accordance with the major needs of the county and in accordance with the major activities of the community clubs. Countywide commissions were established or were to be created in connection with specific agricultural enterprises, recreation, and health.

This is the organizational structure and process within which the promotion of voluntary health insurance on a group basis is and has been pursued in Haywood County.

Group Health Insurance

The health insurance purpose of the Haywood County Community Development Program was stated in the 1951 Annual Report of the County Agricultural Extension Agent as follows: "The officers and directors of the community development program are very much interested in securing for the rural people of Haywood County the same benefits received by industrial and common-employer groups in

the county from group hospital and surgical insurance."

In addition to being an "organized community," each of the four localities had churches and one or more other organizations, such as home demonstration clubs. However, each organized community, in addition to being an integral unit of the countywide community development program, enjoyed a wide reach of participants through its embracive program of activities and, therefore, was in a key position to serve as a group base for enrollment in voluntary health insurance.

The possibility of developing a voluntary health insurance program was first discussed at a regular monthly meeting of each organized community. A local physician and a member of the countywide board of directors of the community development program presented general information on such insurance. The members, after some discussion, voted in favor of having the county board of directors proceed to seek a definite group health insurance plan.

During a period of 6 to 8 months, a specific plan was worked out with an insurance carrier and the necessary arrangements were made through the State Insurance Commissioner for the community development program to serve as a basis for enrollment in a group health insurance plan. The specific insurance program was presented at another regular monthly meeting of each organized community. Those participating actively at this second round of local meetings were local physicians, the local hospital administrator, a member of the county board of directors, and a representative of the insurance carrier. Community members voted to support the insurance program, and campaigns for enrollment in each community followed.

The fact that each community achieved the necessary 75-percent enrollment of all families, counting those already enrolled in a work-group employment plan, to qualify for the group enrollment arrangements reflects the strong local support given to the program.

In each community, a local person serves as chairman for the health insurance activity, collects premiums on a quarterly basis, and furnishes information on the insurance plan. He also is expected to stimulate new memberships

in the group enrollment plan, which is opened semiannually for new members. This local collector is paid a small fee by the members.

Group enrollment in voluntary health insurance through the Haywood County Community Development Program began in June 1951. Insurance was carried with a commercial insurance company for the first year. In June 1952, a nonprofit agency took on the health insurance program, and in January 1954 another nonprofit agency became the carrier. The community development program has been able to "weather" these two changes of health insurance carriers within a relatively short period of time, with all the attendant variability in some of the health insurance coverages and premiums.

Voluntary Health Insurance Enrollment

The strength of the enrollment effort in the four communities is reflected in the relatively high proportion of residents enrolled in the voluntary health insurance plan in June 1953, the time of the study. Two-thirds of the 299 households reported had some health insurance for one or more persons in the household; about three-fifths of the 1,222 individuals in these households had such insurance.

The following analyses are based on data for male heads of the households only. It is probable that the impact of community organization on health insurance enrollment for male heads of households represents the situation generally for all individuals in the localities studied.

The prominent role of group affiliation as the basis for subscribing to voluntary health insurance was impressive. There were 270 male heads of households, and 154 (57 percent) had health insurance. More than 9 of every 10 were enrolled on a group basis. More than 3 of every 5 male heads of households who had health insurance were enrolled on a group basis in industrial plants and in other group employment situations.

The direct contribution of the Haywood County Community Development Program to health insurance can be measured by the data showing that about two-fifths of all enrolled male heads of households were enrolled on the group basis sponsored by that program.

Only about 1 in every 7 enrollees had subscribed as individuals. Proportions are cumulative to more than 100 percent because of a few cases of enrollment in two or more types of health insurance.

The effect of contributions of the community development program to voluntary health insurance enrollment was further demonstrated by the program's particular ability to enroll two groups usually less available to health insurance—farmers and low-income households. Of all farm operators enrolled, 4 of every 5 in 1953 had enrolled in the group plan sponsored by the Haywood County Community Development Program. Of the enrolled male heads of households who had annual net cash incomes of less than \$1,500, 2 of every 3 had enrolled with the community group program. Although health insurance enrollment among farmers and other workers in nongroup employment, as well as male heads of households with low incomes, was still relatively low in the four rural communities in the study, the community development program's particular success in enrolling many of them encourages further efforts.

Conclusions

What do these data mean? What are the implications of this study? First, the results are sufficiently fruitful to indicate an area for further research. Several similar studies are necessary, however, before the results can be considered conclusive. The data in this single study appear to be sufficiently pointed to warrant consideration of possible action along three lines.

1. Voluntary health insurance carriers may need to reexamine their concept of "group." Groups of many kinds that do not charge dues or maintain membership rolls are found in communities. Such locality groups as neighborhoods and communities, when sufficiently organized, may be the means of reaching families living in open-country communities that are dependent upon agriculture for a livelihood, as well as other self-employed workers. Such a change in the concept of "group" may necessitate major alterations in many State laws and

administrative interpretations that relate to voluntary health insurance. In selecting personnel for selling and maintaining insurance in rural communities, carriers may need to consider this change in concept.

2. The implication of these data appears to be clear-cut for community leaders interested in health matters. Efforts in the direction of complete community organization, as contrasted with another special-interest group in health, appear to be fruitful for exploration. This seems to be a way of arriving at a "group" so as to take advantage of a group basis for voluntary health insurance. Also, this procedure opens channels of communication and uses social control techniques which are not possible under many other conditions. Through this procedure, some open-country families can be reached more adequately than through more specialized groups.

3. In training public health personnel, as well as personnel of other agencies functioning in rural areas, institutions may need to alter their training programs to include, or expand, community organization principles, procedures, and techniques. Professional personnel must give more attention to leadership training of lay persons for the assumption of communitywide responsibility. These agencies are in rural areas for the purpose of aiding rural people to raise their levels and standard of living. Health is generally recognized as one of the important aspects of levels and standards of living and many persons are of the opinion that voluntary health insurance is an important element in improving the health status of rural residents. It would appear that all agencies working in rural areas must in the future give more attention to community organization.

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Continued High Incidence of Diphtheria in a Well-Immunized Community

By W. J. MURPHY, M.D., M.P.H., V. HAMILTON MALEY, M.D.,
and LILLIAN DICK, B.S., R.N.

THE incidence of diphtheria in the United States has steadily declined during the past few decades. Morbidity and mortality have decreased in each of the various geographic areas, but not to a similar extent (1, 2). The most abrupt drop has occurred in the Northeast, which prior to 1920 reported the highest rates in the country. In contrast, the most leisurely decline was observed in the South. At present, the rates reported from several of the southeastern States, including Georgia, are among the highest in the Nation.

Although evidence indicates that the abrupt drop in diphtheria morbidity during the past 25 years is related to the widespread use of active immunization, it is generally agreed that other factors have contributed to the decline. It is probable, too, that current variations in incidence in different areas may be due, in part, to factors unrelated to artificial immunization.

In an area of north Georgia comprising 10 counties with a combined population in 1950

of 156,175, the average annual morbidity rate for 1949-53 was 26.2 per 100,000 population as compared with a rate of 7.6 for the State. At the center of that area is Hall County, which reported an average annual rate of 47.8 during the same period. This report deals primarily with the diphtheria experience of Hall County.

Hall County, Ga., is located in the Piedmont Plateau of the foothills of the Appalachian Mountains and had a population of 40,113 in 1950, approximately 10 percent of which was Negro. Gainesville, the principal city, had a population of 11,936. On the whole, the county is prosperous and ranks in median family income among the upper 15 percent of Georgia's 159 counties.

Medical, public health, and hospital facilities are considered adequate. Since 1921, Hall County has had an organized health department with full-time professional personnel. Gainesville has a modern hospital with 114 beds. In 1953, there were 27 practicing physicians in the county.

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Diphtheria Incidence

From 1935 through 1953 no appreciable decline was observed in the diphtheria incidence in Hall County. This is shown in table 1 which compares the county's average annual morbidity and mortality rates with those for the State.

In view of the small Negro population in

Table 1. Average annual morbidity and mortality rates per 100,000 population for Hall County and for Georgia, 1935-53

Years	Georgia		Hall County	
	Mor-bidity	Mor-tality	Mor-bidity	Mor-tality
1935-39	35.3	3.9	31.0	3.0
1940-44	18.4	1.7	35.6	1.7
1945-49	14.1	1.2	66.7	2.6
1950-53	6.4	.4	28.8	2.4

Hall County, the white and Negro rates are not considered separately. Until recently, the reported incidence of diphtheria in the white population was considerably above that for the Negroes. The rate for the white population has declined more rapidly, however, and since 1952 it has been slightly below the rate for Negroes.

The age distribution of diphtheria in Hall County does not differ appreciably from that of the State. At present in Georgia approximately 85 percent of all cases are reported in children below the age of 15 years, the highest rate being observed in the group 5 to 9 years old.

During the 5-year period 1949-53, diphtheria occurred in all sections of the county with relative frequency. Of the 96 cases reported for the period, 28 occurred in Gainesville and 68 in the remainder of the county. The average annual rates per 100,000 population for the 2 areas were 46.9 and 48.2, respectively. No undue concentration of cases was apparent in any particular occupational group. In keeping with the seasonal rise in incidence observed throughout the State, 50 percent of the cases were reported in October and November.

Diagnostic Criteria

To evaluate the criteria of diagnosis, we reviewed the records of the 96 cases of diphtheria reported during 1949-53. Primary consideration was given to: (a) the occurrence of a febrile illness of several days' duration; (b) evidence of a localized infection as indicated by a membrane in the throat, laryngeal involvement, or both; and (c) laboratory studies. In approximately four-fifths of the cases the local

and constitutional symptoms and the laboratory findings were consistent with a diagnosis of diphtheria. Some patients were described as having a febrile illness, sore throat, and a positive culture, but they lacked a typical membrane. In the remaining cases, the diagnosis was based on clinical grounds, characteristically on the appearance of the membrane. Apparently, the diagnostic criteria in Hall County were comparable to those in other areas of the State.

Cultures

Since October 1948 all virulent diphtheria cultures received by the central laboratory of the Georgia Department of Public Health have been forwarded for typing to the Laboratory Branch of the Communicable Disease Center, Public Health Service. And since July 1950 virulent cultures received by the branch laboratories have also been forwarded for typing.

A total of 927 virulent cultures were submitted for typing from October 1948 through June 1954. This figure represents the number of persons from whom cultures were received, and it includes only actual cases and intimate contacts.

The different types of *Corynebacterium diphtheriae* found in the various areas of the State are shown in table 2. The classification method is the one used by Frobisher (3). Gravis strains predominated in north Georgia, particularly in Hall and adjacent counties, but comprised only a small proportion of the cultures received from central and south Georgia.

The area designated as north Georgia represents approximately the northern two-fifths of the State. It includes 59 counties, 9 of which are contiguous with Hall County.

Of the cultures received from Hall County, approximately one-third were obtained from clinical cases and the remainder from household contacts. In numerous instances, unfortunately, cultures from hospitalized patients were not forwarded for typing to the Georgia Department of Public Health. Of the 96 cases reported during 1949-53, cultures were received from 55, and, of these, 52 were gravis and 3 were mitis. In 13 additional instances, cultures were received from one or more members

Table 2. Diphtheria cultures classified according to type, received from four areas of Georgia, October 1948-June 1954

Area	Total cultures	Gravis		Mitis	Minimus	Indeterminate
		Number	Percent	Number	Number	Number
Total for State	927	393	42.3	413	105	16
Hall County	169	154	91.1	14	0	1
Adjacent counties	70	48	68.6	17	2	3
Other counties in north Georgia	372	165	44.4	177	22	8
Counties in central and south Georgia	316	26	8.2	205	81	4

of the immediate family but not from the patient. In 12 of these instances, cultures were gravis in character and 1 was indeterminate.

Immunization Status

The immunization status of 96 diphtheria patients (1949-53) was obtained from their clinical records. Patients recorded as having received one or more doses of an immunizing agent were separated into two groups: (*a*) those who had received at least 3 doses of an antigen, the last one within 3 years of the date of illness; and (*b*) all others who had received at least 1 dose. The first were considered to represent immunization failures while in the second group protection was classed as inadequate or lapsed.

Information as to prior immunization was available for all but 14 of the 96 cases. The findings are summarized below.

Immunization	Number cases
None	48
Inadequate or lapsed	27
Immunization failure	7
Unknown	14

Of the 27 patients for whom immunization was recorded as being inadequate or lapsed, 5 had received one dose and 3 had received 2 doses of alum-precipitated toxoid within 3 years of the date of illness. For the remaining 19, there was an interval of more than 3 years between the date of the last inoculation and the onset of illness.

The 34 patients in the innoculated group in-

cluded 12 preschool and 22 children of school age, 7 boys and 27 girls. This apparent sex difference may be of some significance since a similar preponderance of cases among girls in inoculated groups has been reported by other workers (4).

In the unimmunized group there were 36 preschool and 10 school-age children and 2 adults above age 30. Of these 48 patients, 25 were males and 23 females.

Four of the 96 diphtheria patients died. None of the four had received an immunizing agent.

Active Immunization

In April 1953, a study was made of the extent to which active immunization was being employed in Hall County. For that purpose, a 10-percent sample of recorded live births during 1948-51 was obtained by selecting every 10th name from an alphabetical list prepared by the Georgia Division of Vital Statistics. The names appearing in the sample were checked against the records of the Hall County Health Department. Those not appearing in the files were checked against the records of three pediatricians. The remaining names that failed to appear in the physicians' records were arranged alphabetically, and a 20-percent sample was obtained by selecting every fifth name. The homes of the selected children were visited. If there was a history of prior immunization, the name of the physician administering the inoculations was obtained and his office was visited. A child was included in the

inoculated group only if an immunization record was on file. Those who had moved from the county were considered unimmunized. Infants who had died prior to the study were not excluded from the tabulations.

The 10-percent sample of live births for the period, 1948-51, included 395 names. The records of the Hall County Health Department and those of three pediatricians showed that 239 had received one or more doses of a diphtheria antigen. In 192 instances, the inoculations had been given during the first year of life. Since a considerable period of time is required in administering multiple doses of an antigen, the date of the first inoculation was used.

For the most part, a combined diphtheria-tetanus-pertussis antigen had been administered, although during 1948 and 1949, the primary series sometimes consisted of 2 doses of alum-precipitated toxoid. Of the 239 infants for whom immunization records were on file, 184 had received at least 3 doses of a combined antigen; 37 had received 2 doses of an antigen, chiefly alum-precipitated toxoid, and 18 had received only 1 dose.

There remained 156 names which did not appear among the immunization records. As stated previously, a 20-percent sample was obtained, and the 31 children in the sample were visited. A history of prior immunization was obtained for 12 children and verified by a visit to the physician's office. Of this group, 9 had been inoculated during the first year of life. For 12 children, there was no history of prior immunization and 7 families had moved from the county.

The proportion of Hall County children born during 1948-51 who had received an immunizing agent during the first year of life was estimated as:

$$\frac{192 + (5 \times 9)}{395} = 60 \text{ percent.}$$

The estimates of 68.3 percent for the second and 74.4 percent for the third year of life were similarly prepared.

The inoculated group included only children with immunization records, and since infants who died were not excluded and those who had moved from the county were considered un-

immunized, the actual immunization rate probably exceeded the estimated figures.

By the age of 6 years, the proportion of inoculated children in Hall County approached 100 percent. Prior immunization against diphtheria is a requirement for entrance to school, and although the regulation is not rigidly enforced, comparatively few children fail to comply with it. It is also routine practice for representatives of the health department to visit the schools in the fall and to administer recall doses to those in the lower grades who have not received one within 3 years.

Schick Tests

In December 1953, the children in 1 Negro and 2 white schools were Schick tested. The test group included 1,838 children ranging in age from 6 to 18 years. Both urban and rural areas were represented. Tests were made by injecting intradermally into the forearm 0.1 cc. of an appropriate dilution of a standard diphtheria toxin. Control tests were not employed. Readings were made on the sixth day and doubtful reactions were read as positive. Since the findings in each school group did not differ appreciably, they were considered together (table 3).

Even assuming some margin of error in connection with the technique employed, it is apparent that comparatively few school children in Hall County are Schick positive. This obviously implies an unusual immunization rate, either natural or artificial, or both.

In a number of previous surveys of school

Table 3. Number and percent of positive Schick tests by age, Hall County, Ga., December 1953

Age (years)	Num- ber tests	Num- ber posi- tive	Per- cent posi- tive
All ages	1,838	106	5.7
6-7	412	27	6.5
8-9	351	16	4.5
10-11	379	20	5.2
12-13	316	18	5.6
14-15	227	17	7.4
16-18	153	8	5.2

children in the South (5, 6), the proportion of Schick-negatives was also found to be high, even among those who had never received an immunizing agent. Similarly, in Schick surveys of young men entering the armed services (7, 8), the frequency of positives among men from the South has been lower than among those from most other areas of the country. In view of the findings in previous surveys, the results in Hall County are not surprising when considered in connection with the high diphtheria morbidity and the extent of artificial immunization.

Discussion

The continued high incidence of diphtheria in Hall County is of interest in view of the general decline experienced throughout the Nation and in most areas of Georgia. Although it is conceivable that a variety of factors may have contributed to the Hall County experience, this study has been concerned primarily with the extent of active immunization, the prevailing strain of *Corynebacterium diphtheriae*, and the frequency with which clinical infections occurred among the immunized.

Hall County has had an organized health department for more than three decades and during most of that time immunization against diphtheria has been stressed by health officials and physicians alike. That the program has been reasonably successful in reaching a large proportion of the preschool population is indicated by the results obtained in checking a sample of live births against available immunization records. Although the estimates based on that sample cannot be readily compared with those reported from other areas in the past, immunization apparently has been used more extensively in Hall County than in numerous other localities (9-11), which have experienced a far lower incidence of diphtheria for a number of years. Obviously, the Hall County experience cannot be attributed solely to a lack of interest in active immunization. On the contrary, the incidence of diphtheria has continued at a high level despite a well-organized immunization program.

On the other hand, the evidence indicates that the use of a diphtheria antigen afforded

an appreciable degree of protection when recommended schedules were followed. In view of the proportion of children who had received an immunizing agent, 60 percent by the age 1 year and almost 100 percent by the age of 6 years, it is apparent that clinical infections were observed much less frequently among those who had received one or more inoculations. Moreover, of the infections observed in the inoculated group, the great majority occurred following inadequate dosage or after protection had been permitted to lapse.

It is possible that the high diphtheria incidence in Hall County may be associated with an unusually aggressive strain of *C. diphtheriae*. Since October 1948, when routine typing was begun, more than 90 percent of the cultures from that county and almost 70 percent of the cultures from neighboring counties have been gravis strains. The findings are in sharp contrast to the diphtheria flora usually encountered in other areas of the United States (12-14). Moreover, the serologic studies reported by Hermann and Parsons (15) indicate that the gravis strains isolated in north Georgia are closely related antigenically.

However, the clinical manifestations of the disease have not been unusual and case fatality rates have not been excessive, even among the unimmunized.

The association of a gravis strain with the continued high incidence of diphtheria in Hall County is not necessarily peculiar to that type of *C. diphtheriae*. Presumably, other types might be involved elsewhere in similar situations.

Summary

From 1935 through 1953, the incidence of diphtheria in Hall County failed to decline in spite of a well-organized immunization program.

A study based on a sample of live births indicates that at least 60 percent of the infants born in the county receive an immunizing agent by the age of 1 year. By the age of 6 years, the figure approaches 100 percent.

A review of the diphtheria cases reported during the period 1949-53 indicates that active immunization afforded an appreciable degree

of protection. Of the cases observed among previously inoculated children, the great majority occurred following inadequate dosage or after protection had been permitted to lapse.

Since October 1948, more than 90 percent of the cultures received from Hall County have been gravis strains. In central and south Georgia gravis strains were encountered infrequently.

The clinical manifestations of the disease in Hall County have not been unusual.

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Warns Against Hoxsey Treatment

An official public warning against use of the Hoxsey treatment for internal cancer was issued April 4, 1956, by the Food and Drug Administration.

The warning was based on the finding by the United States Court of Appeals for the Fifth Circuit that the treatment was worthless. Analysis of the contents of the liquids and pills issued by the Hoxsey clinics at Dallas, Tex., and Portage, Pa., showed no value in the cure of cancer and that they contained potassium iodide, a compound which has been indicated as one that may accelerate growth of some cancers. In addition, the Food and Drug Administration, despite a thorough study, stated it had not found a single verified cure of internal cancer effected by the Hoxsey treatment.

An injunction obtained October 26, 1953, prohibits the shipment of Hoxsey "medicines" in interstate commerce if the labeling represents, suggests, or implies that they are effective in the treatment of any type of internal cancer.

Questions put to homemakers in Rochester and Syracuse, N. Y., evoke a striking relation between knowing and doing.

Nutritional Knowledge and Practices

By CHARLOTTE M. YOUNG, Ph.D., KATHLEEN BERRESFORD, M.S.,
and BETTY GREER WALDNER, M.N.S.

WHY are some people less well fed than they might be, even when their income is sufficient? A study in New York State demonstrated that in a number of families where there were dietary inadequacies lack of income was not the primary cause (1). May one explanation be that homemakers do not know what to feed their families to provide a nutritionally adequate diet? Studies in Richmond, Va., in 1947 indicated that adequacy of family feeding might be related to the level of homemakers' knowledge about food and nutrition (2).

Public health workers, teachers, extension workers, and school lunch managers are interested in determining what knowledge about food and nutrition the homemaker applies to feeding her family. On what nutrition subjects have we succeeded in educating the homemaker? Where do we need to do better? What problems do homemakers have in planning, buying, or preparing food for their families? Do they seek help with these problems? What kinds of help? Where has the homemaker obtained her present information on food and nutrition?

In an attempt to answer some of these questions, we studied the food and nutrition knowl-

edge and practices of cross-sectional representative samples of homemakers in two upstate New York cities, Rochester and Syracuse, in the early fall of 1953.

Survey Techniques

Data were collected by trained interviewers directly from homemakers, that is, persons responsible for planning family meals. The interview used pretested open-end questions. The interviewer recorded responses as nearly as possible in the homemaker's words. Ninety-six questions were asked. An average interview lasted 1 hour.

Sampling was directed by P. J. McCarthy, director of the Cornell University Statistics Center, Ithaca, N. Y. Within the city limits of Rochester, population 332,488, and Syracuse, population 220,583 (1950), sample blocks were drawn with probability proportionate to size, based on the census of housing block statistics for 1950. All private dwelling units in the sample blocks were listed, and those to be interviewed were selected by a field supervisor in a central office in accordance with a scheduled sample interval starting with a random number. Validation of the samples by comparison with statistics from the 1950 census is reported in detail elsewhere (3). The educational attainment level of the homemakers in the Syracuse sample was somewhat higher than that of Syracuse women reported in the 1950 census. No single-person dwellings were used.

Completed interviews in Rochester numbered

Dr. Young is professor of medical nutrition, Mrs. Berresford was an assistant professor of public health nutrition, and Mrs. Waldner was formerly an instructor in the School of Nutrition, Cornell University.

Table 1. Percentages of homemakers who named and understood why given foods should be served with each meal, and percentages using such groups in the previous 24 hours

Basic food groups	Naming as necessary meal components		Giving reason for inclusion		Using in past 24 hours	
	Rochester	Syracuse	Rochester	Syracuse	Rochester	Syracuse
Meat, fish, poultry, etc.	97	96	36	50	99	99
Potato, other vegetables and fruits	96	95	34	46	92	93
Milk, cheese, ice cream	68	58	31	32	82	87
Bread, flour, cereals	55	52	16	19	99	99
Leafy, green, or yellow vegetables	13	17	7	10	65	60
Butter or fortified margarine	12	13	4	4	78	74
Citrus fruit, tomato, cabbage	9	9	3	6	72	71

331 and in Syracuse, 315, representing in each city 63 percent of the sample drawn. The disposition of the rest of the sample drawn included 12-percent refusals in Syracuse and 14 percent in Rochester. The most frequent reasons given for refusals were "not interested," or "too busy," but they also included serious illnesses or recent deaths in the families, inability to speak English, apparent mental incompetency, and refusal to answer the door. The remaining 25 and 23 percent of the sample drawn were accounted for almost equally by single person dwellings and by families not at home on at least three interview attempts at different times of the day and evening.

Responses to various parts of the questionnaire were tabulated and related to the following factors: age group of the homemaker, her level of formal educational attainment, whether or not she had ever "studied about what to eat," and family income level. The age groups used included the following: young (under 40 years of age), middle-aged (40 to 60), and older (over 60). Homemakers were grouped in three levels of educational attainment—those who had not attended high school, those who had attended but not completed high school, and high school graduates. Divisions used for family income level were under \$3,500, \$3,500-\$4,999, and \$5,000 or over.

The homemaker's knowledge was assessed according to her response to a number of questions. Among others these included:

1. What do you feel should be included in the meals for your family each day? Why do you feel (name of food) should be included? Why does your family need that?

2. Maybe you have heard or read about a so-called balanced diet. What does a balanced diet mean to you?

3. Do you know what is meant by the "basic seven"? What are the groups in the "basic seven"?

4. What other foods could be used in place of milk? When you do not wish to serve meat, fish, or poultry, what foods do you think you can serve in their place and get some of the same food value? When you do not have oranges or grapefruit is there anything you can serve that would give you about the same food values? What?

Nutritional Knowledge

Response to the question of what should be included in the family's meals each day is shown in table 1. If a homemaker named an important nutrient contribution or nutritional function served by the food group mentioned, the interviewer credited her with giving a correct reason. For example, in answer to questions about why meat and milk should be served each day, typical correct replies might include:

Meat—"because it has lots of iron" or "because it builds good red blood" or "protein" or "because it builds muscle."

Milk—"for strong bones and teeth" or "because it has lots of calcium."

In contrast, replies such as "good for you," "to grow," "because we like it," or "need it" were not interpreted as indicating specific nutritional knowledge. Those who could give a correct reason for three or more groups were said to have "adequate knowledge"; those who

could not do so for any group, "no knowledge"; and those in between, "some knowledge."

The conventional foods, such as meat or meat substitutes and potatoes and other vegetables and fruits, were mentioned for inclusion in meals by almost all of the homemakers. Only a few in the study mentioned items more likely based on nutritional knowledge than custom.

None of the homemakers mentioned all 7 of the basic food groups; only 3 percent named 6 of them; an additional 12 to 14 percent, 5. The great majority mentioned only 3 or 4 groups.

Only one-third to one-half of all the homemakers had enough knowledge to give correct reasons for inclusion of any of the food groups. Again meat or meat substitutes, potatoes and other vegetables and fruits, and the milk group were best known. Only 3 to 6 percent of the homemakers knew a reason for including vitamin C-rich fruits; 7 to 10 percent, carotene-rich fruits and vegetables; 4 percent, butter or fortified margarine; 16 to 19 percent, bread, flour, or cereals.

Assessment of nutritional knowledge was based on the number of food groups for which each homemaker could give a correct reason for inclusion in her family's meals. Nineteen percent of the Rochester and 30 percent of the Syracuse homemakers gave evidence of an adequate knowledge as defined in this study; 32 and 36 percent, some knowledge; 34 and 49 percent, no knowledge.

Approximately one-fourth of the homemakers in both cities defined a balanced diet in such a way as to show the expression was meaningful to them. Two-thirds to three-fourths of the homemakers said they had never heard of the basic seven. Only 10 to 20 percent who had heard of the term could name at least one of these food groups.

The percentage of homemakers in each city who could name possible nutritional substitutes for each of three basic foods is shown in table 2. Again, the meat group was best known.

The younger and better educated homemakers definitely displayed more knowledge of nutrition than the older and less well educated. Since age and educational level proved to be closely associated, it was felt that educational

level was the determining factor. There was no consistent relationship between family income level and the homemaker's knowledge of nutrition. What income influence appeared to be present was found to be due largely to educational differences. This finding occurred when the income and educational influences were segregated by two-way tabulation for any given measure of nutritional knowledge. Details of these relationships and supporting data are reported elsewhere (4).

In Rochester there were 35 percent and in Syracuse 40 percent of the homemakers who reported they had "studied about what to eat." Most of them had studied the subject in public school. Only a few reported study under other circumstances such as courses offered by the Red Cross, home bureau, and cooking schools. Regardless of which measure of nutritional knowledge was used, a higher percentage of homemakers who had studied about what to eat had some knowledge of nutrition which was lacking in those who had not studied.

Performance

In relating the performance of the homemaker in feeding her family to her knowledge of nutrition, we considered: (a) recall by the homemaker of foods served her family in the previous 24 hours and whether or not the meals had been typical; (b) recall of beverages (separately for children and adults) served at each meal; and (c) quantitative information obtained by the homemaker's recall of the amounts of certain key foods used during the previous week.

Family income and age and education of the homemaker were related to performance, and nutritional knowledge was related to performance on a group basis. The practices of home-

Table 2. Percentages of homemakers with knowledge of correct nutritional substitutes for three basic foods

Basic food	Rochester	Syracuse
Meat, fish, or poultry-----	61	63
Milk-----	35	44
Citrus fruit-----	28	35

makers with little or no nutritional knowledge were compared with those who had adequate knowledge.

The performance of the homemaker in feeding her family was considerably better than her knowledge (table 1). Homemakers who actually used each food group were more numerous than those who mentioned that it should be included in the meals or those who knew why. However, the food groups that were least well known were also least used. It would seem likely that for those groups where knowledge is necessary to appreciate the need for their inclusion in the family meals, inclusion in the 24-hour period was a matter of chance. Certain food groups, such as meat or meat substitutes, potatoes and other vegetables and fruits, and bread, flour, or cereals, are included in most meals conventionally. Probably butter (or fortified margarine) was used more than the figures indicate. Its use may not have been recalled. The figures presented for food usage in the previous 24 hours are almost identical, with minor variations, to those obtained in urban and rural Virginia and in two rural school districts in New York (2, 5).

Approximately 40 percent of both the Rochester and Syracuse homemakers included all seven food groups in their menus. This figure is lower than the 50 percent reported for urban Virginia (2) but similar to those reported for rural Virginia and rural New York (5).

Milk was the usual beverage served at most meals for children. But in substantially all of the homes, it was not the usual beverage for adults at any meal. Only 13 percent reported it as one of the adult beverage choices at breakfast, 33 to 44 percent at noon, and 31 percent at night.

A quantitative estimate of the adequacy of feeding practices with respect to four food groups is presented in table 3, with the bases used in evaluation of adequacy. In about one-fifth of the homes, less than half the suggested quantitative needs of the family were met for both the milk and citrus fruit groups. Again, practice is shown to be best with regard to usage of the meat and meat substitutes group.

Feeding practices did not vary so much with age and education as did levels of nutritional

Table 3. Percentages of households using adequate quantities of four given food groups during week

Food groups and adequacy levels	Rochester	Syracuse
<i>Milk</i>		
Less than 50 percent of need ¹ -----	20	19
At least 90 percent of need ¹ -----	34	31
<i>Eggs</i>		
One per day per person-----	39	33
Three or more per week per person-----	98	98
<i>Meat, fish, or poultry</i>		
Two pounds per week per person over 10 years of age and one pound per week per child under 10 years of age-----	91	88
<i>Citrus fruit, tomato, or juices</i>		
Less than 50 percent of need ² -----	21	20
At least 90 percent of need ² -----	51	44

¹ Based on 1 pint per day per adult; 1 quart per day per child.

² Based on 1 serving of citrus fruit, or equivalent, per day per person.

knowledge. However, the younger and more educated homemakers adhered to better practices than did others. The level of educational attainment of those under study appeared to be the factor which was most consistently related to adequacy of performance in feeding the family. Income effects, as was true for their relationship with knowledge, were considerably less consistent and of smaller magnitude (6). Homemakers who reportedly had studied about what to eat apparently served better meals, both qualitatively and quantitatively, to their families than those who had not studied. The quality of breakfast patterns also improved with the factors which affected other feeding practices (6).

Knowledge and Action

Adequacy of dietary practices appeared to be related directly to the level of the homemaker's nutritional knowledge. As knowledge increased, so did the percentage of homemakers who included certain basic food groups in the 24-hour period (table 4), though differences were not large.

Differences were evident in the groups where knowledge might be expected to be causative. Of homemakers who had an adequate knowledge of nutrition, those who used all seven of the basic food groups in their meals were a far greater proportion (48 percent) than of those with no knowledge (31 percent). Also, more homemakers with an adequate knowledge (76 percent) served nutritionally good breakfasts than did those with some or no knowledge (62 and 51 percent, respectively).

Knowledge of nutrition appeared to be re-

lated to performance as measured in more quantitative terms also (table 5). There was a smaller percentage of homemakers with an adequate knowledge of nutrition in the category of those using less than 50 percent of their family's suggested needs for milk and citrus fruit.

Food Problems and Help Sources

The details on information obtained concerning the planning, buying, and preparation of

Table 4. Percentages of homemakers in each category of nutritional knowledge using given food groups in previous 24 hours

Food group	Rochester			Syracuse		
	Level of knowledge					
	None	Some	Adequate	None	Some	Adequate
Meat, fish, poultry	98	99	100	100	97	100
Potato, other vegetables and fruits	89	93	97	92	91	96
Milk, cheese, ice cream	71	88	95	82	90	89
Bread, flour, cereal	99	99	100	99	100	100
Butter, fortified margarine	93	93	98	97	99	97
Leafy, green or yellow vegetables	62	65	71	61	55	66
Citrus fruit, tomato, cabbage	69	74	78	59	75	81

Table 5. Percentages of homemakers in each category of nutritional knowledge using adequate quantities of three given food groups during week

Food groups and adequacy levels	Rochester			Syracuse		
	Level of knowledge					
	None	Some	Adequate	None	Some	Adequate
<i>Milk</i>						
Less than 50 percent of need ¹	27	15	14	21	21	14
At least 90 percent of need ¹	30	41	35	37	27	30
<i>Meat</i>						
Two pounds per week per person over 10 years of age and one pound per week per child under 10 years of age	85	90	86	84	87	96
<i>Citrus fruit</i>						
Less than 50 percent of need ²	25	24	8	27	22	15
At least 90 percent of need ²	46	51	71	41	41	52

¹ Based on 1 pint per day per adult; 1 quart per day per child.

² Based on 1 serving citrus fruit or equivalent per day per person.

food by homemakers are not reported here. However, it was found that family food shopping is done chiefly by homemakers, usually once a week. Most homemakers do not plan meals much ahead of time. More than 40 percent do their planning on the day of the planned meal or at the "last moment." About two-thirds of the homemakers said they had a specific amount of money to spend for food each week or month. Ninety-two percent of the homemakers felt their families were getting all the needed foods.

One-third of the homemakers said they encountered some difficulty in planning, buying, or preparing food for their families. Two-thirds of those who said they had problems desired help. Means of obtaining variety and planning to suit all of the family's needs were mentioned most frequently. Budgeting, quick menus, food habits, and special diets also were cited as problems in the order named. Younger, better educated homemakers expressed the need for help with more problems than did others.

The homemaker ranked magazines and newspapers as the primary source for information on what to feed the family. Mothers and relatives were the persons most often mentioned as sources. Of professional persons, the greatest number of homemakers felt the physician had given them the most information. Homemakers used recipes and information on food preparation more extensively than other kinds of material supplied. Next most frequently used was information on meal planning and the components of a balanced diet.

Results of the study have been reported to public health, nutrition, education, and extension groups in Rochester, Syracuse, and elsewhere. These have included regional public health and dietetic associations; nutrition committees; nutrition workshops for health, education, and welfare personnel; and workshops for school lunch personnel, for home economics teachers, and for extension workers.

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Repeated Pregnancy Wastage

By F. J. SCHOENECK, M.D.

PRECONCEPTIONAL study, treatment, and other medical attention for women whose pregnancies repeatedly end in misfortune have been accepted as a hope of reducing pregnancy wastage.

I have previously reported that a relatively small group of childbearing women account for a disproportionately high percentage of such wastage (1). Schlesinger and Allaway (2) state that the expectation of perinatal loss among women with a history of previous child loss was 2.7 times greater than among multiparous women without such loss. They concluded: "This trend toward further narrowing of the problem of perinatal loss points to the need for increased concentration of research and public health services on the vulnerable group of women who present a history of previous child loss." Randall, and associates (3) state: "When all other factors were disregarded and the outcome of the present pregnancy was compared among women with good obstetrical history and those with poor obstetrical history, abortion was found to have occurred 20 times more frequently when the previous obstetrical history was 'poor'."

Other articles of the general nature of those quoted are appearing in medical literature. The Syracuse Department of Health is reporting here the pregnancy outcomes of a group of

women selected specifically because of their poor obstetrical histories.

Pregnancy Outcomes

Clinical histories of these women have been gathered in the past 2 years from sources in and around Syracuse, N. Y. These sources included private records, completed prenatal clinic records, and histories obtained by public health nurses in patient interviews in connection with the department's current survey of pregnancy outcomes. The histories were collected primarily as "matching controls" to compare with the histories of patients attending our local prepregnancy treatment clinic.

The material consists of the obstetrical histories of 135 patients who had completed 653 pregnancies (an average of 4.8 pregnancies per patient). There were 3 sets of twins among the 135 patients; 126 (93.3 percent) were white and 9 (6.6 percent) were Negro; 75 (55.5 percent) were private patients, and 60 (44.5 percent) were service cases. Four patients, (2.9 percent) had definite Rh problems.

Outcomes of 653 pregnancies, according to the histories of these 135 patients, were:

	Number	Percent
Living babies.....	201	30.8
Term.....	141	21.6
Premature.....	60	9.2
Unsuccessful pregnancies.....	452	69.2
Postnatal deaths:		
Term.....	8	1.2
Premature.....	64	9.8
Stillborn.....	49	7.5
Abortions.....	324	49.6
Ectopic pregnancy.....	7	1.1

Dr. Schoeneck is the director of the bureau of maternal hygiene, Department of Health, Syracuse, N. Y.

Of the total of 653 pregnancies, 12 babies (1.8 percent) had congenital anomalies. Of 201 living children, 3 (1.4 percent) had retro-lental fibroplasia.

Unfortunately, the information available is not sufficiently complete to allow epidemiological analysis. Such an approach to each patient might establish whether these women have more in common than their obstetrical history. Identification of such common factors is a step toward their elimination or control.

There is some question in our minds about the complete reliability of the retrospective observations of these women, but we are gathering data from our continuing study which we hope will provide clues for further preventive and remedial action.

Reduction in infant loss and salvage of babies from unusual pregnancies have certainly not kept pace with the reduction in maternal mortalities. Pregnancy salvage for the minority of unsuccessful patients is a challenge to the public health-obstetric-pediatric team.

Comments

We subscribe to the current methods of correction as exemplified by the present programs in New York City, Chicago, and New York State, outlined by Yankauer (4) and by various other professional groups and health agencies. In general these programs aim at improving care during the prenatal, labor, and delivery periods, and pediatric care.

Our previous studies in the field of unsuccessful pregnancies would seem to indicate that fetal salvage is essentially an obstetrical problem (5). Hughes (6) in speaking of fetal salvage states: "Although we believe that all these standards should be carried out carefully; that prenatal care should be improved; that pediatric care after birth should be made bet-

ter, we are of the opinion that in order to reduce the infant death rate to a new low in this country, we must take a more specific approach to the problem."

One example of a specific approach is the preconceptual study and prophylactic treatment of women with a history of repeated unsuccessful pregnancies, as carried out by Hughes and his group in Syracuse. Many other types of study are necessary to cope with the obstetrical complications so often associated with abortion or fetal loss.

Public health activities can play important roles in such a program. As an example, in Syracuse we are trying to find women who have or probably will have unsuccessful obstetrical experiences so that they may be studied and perhaps helped to bear healthy babies.

Women with habitual pregnancy loss should be recognized as having specific problems worthy of consideration from all interested medical groups.

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Cancer in Iowa

Of each 100,000 Iowa residents, 509 persons had cancer during 1950; 347 of these were first diagnosed during the year. Females had a slightly higher incidence rate than males. When adjustments are made for the age distribution of the population, the Iowa incidence rate for all sites excluding skin, 253, was 12 and 9 percent below the respective figures for the combined 10 cities (286) and the 4 northern cities (277) recently surveyed by the National Cancer Institute of the Public Health Service. Much of this differential can be attributed to a lower rate in rural Iowa. The rate for urban Iowa agreed well with that reported for the four northern cities.

In Iowa, 76 percent of the newly diagnosed cancer cases were confirmed microscopically. This was essentially the same as the combined figure from surveys of the 10 urban areas. The urban-rural differential in this respect was small—77 percent contrasted to 73 percent—which suggested about equal reliability of diagnoses in the two population groups. In view of the proportion of cases with microscopic confirmation in Iowa, it may be noted that most comparisons and inferences drawn from the Iowa data remained essentially unchanged, whether based on total newly diagnosed cases or solely on those meeting exacting diagnostic criteria.

Among Iowa males, cancer occurred most frequently in the digestive system, skin, genital organs, buccal cavity, and respiratory system. Among females, the order was genital organs, breast, digestive system, and skin. The leading specific sites for males were prostate, stomach, large intestine, and lung; for females, breast, cervix, and large intestine.

Incidence rates in the urban population were higher than in the rural population for such primary sites as lung, larynx, and cervix. Several lines of indirect evidence, based partly

on examination of the data for internal consistency, support the hypothesis that these differences are real. There was little difference in the incidence of cancer of the corpus uteri, breast, prostate, and digestive system among urban and rural residents.



No. 37

The accompanying summary covers the principal findings presented in Public Health Monograph No. 37, published concurrently with this issue of Public Health Reports. The authors are with the National Cancer Institute, National Institutes of Health, Public Health Service, Bethesda, Md., and the Iowa State Department of Health, Des Moines, Iowa.

Readers wishing the data in full may purchase copies of the monograph from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A limited number of free copies are available to official agencies and others directly concerned on specific request to the Public Inquiries Branch of the Public Health Service. Copies will be found also in the libraries of professional schools and of the major universities and in selected public libraries.

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Haenszel, William, Marcus, Samuel C., and Zimmerer, Edmund G.: *Cancer morbidity in urban and rural Iowa*. Public Health Monograph No. 37 (Public Health Service Publication No. 462). 85 pages. Illustrated. U. S. Government Printing Office, Washington, D. C., 1956. Price 20 cents.

Excluding cancers of the lymphatic tissue and the hematopoietic system, two-thirds of the newly diagnosed cancers were localized at time of diagnosis. One of four had spread to adjacent tissue or regional lymph nodes, and 1 of 10 had metastasized to remote tissues. More cancers in males were diagnosed while localized (71 percent, excluding lymphatic tissue and hematopoietic system) than in females (63 percent). This resulted not from a systematic sex differential for certain sites but from the preponderance of breast cancer among women, for which the probability of early diagnosis has been relatively poor. The greatest variable in stage at diagnosis was shown with regard to primary site. To illustrate, only 49 percent of cancers involving the digestive system were diagnosed while localized compared to 86 percent for buccal cavity. In general, the proportion of localized cases was higher for the more accessible sites.

Of every 100 residents with newly diagnosed cancer in Iowa, 75 were alive 6 months after diagnosis, and 66 were still alive after 1 year. There was no difference in the urban and rural experience with respect to survival. Stage at diagnosis had the most pronounced effect on survival rates. Of cancer cases diagnosed while localized, 81 percent survived 12 months as contrasted to 45 percent of those with regional involvement and 27 percent, with remote metastasis. Uterus and large intestine are among the sites exhibiting the greatest range in survival rates for cases in early and late stages. Survival rates for certain sites, such as pancreas and lung, are extremely poor even when diagnosed early.

With respect to primary site of cancer, agreement between data on medical records and on death certificates was good. For most primary sites, comparisons between urban and rural areas based on incidence and mortality rates were in close agreement.

Morbidity data reported from Denmark generally show findings similar to those from Iowa with respect to urban-rural differentials. Both showed substantial differentials in incidence for all sites combined (exclusive of skin, lymphatic tissue, and hematopoietic system). For lung and bronchus, both sets of data exhibited a much more pronounced urban-rural differen-

tial among males. They agreed on two distinct urban-rural patterns for cervix and corpus uteri. Neither the Danish nor Iowa data supported impressions of higher skin cancer incidence rates among rural populations as reported in medical textbooks.

The age and sex patterns of cancer incidence in Iowa conformed generally to those reported from morbidity surveys elsewhere. Incidence of cancer increased rapidly during late adult life for both sexes. Although female rates for all ages combined exceeded those for males, females experienced lower rates at ages under 10 and over 65.

Although most cancers tend to appear in late adult life, some forms occur relatively frequently among young people. Less than 5 percent of the newly diagnosed cases in Iowa occurred among persons under 35, whereas one-fourth of cancers of the brain and endocrine glands, not elsewhere classified, and one-fifth of those in the skeleton and hematopoietic system were in this age group.

Carcinoma constituted 86 percent of the newly diagnosed, microscopically confirmed cases of cancer in Iowa, a figure in close agreement with that from the 10-city morbidity surveys. Within Iowa there was no difference in this respect between urban and rural residents. Adenocarcinoma was more frequent among females, whereas epidermoid carcinoma was the leading type among males. One site—breast—accounted for much of the preponderance of adenocarcinomas among females. Leukemia was the most frequent histological type encountered at ages under 15. Thereafter, carcinomas became increasingly predominant.

During 1950, 6,979 cancer patients were hospitalized for a total of 159,316 days, an average of 23 days per patient. The average length of stay did not differ for patients from urban and rural areas. Cancers of the digestive system alone accounted for about one-third of the total hospital days. Of the newly diagnosed resident cases, 59.2 percent were hospitalized within 1 year after diagnosis. The first course of hospitalization for newly diagnosed cases accounted roughly for three-fifths of the total hospital days devoted to cancer treatment. The average duration of first hospitalization was 20 days.

Does the nitrification of soil contribute to methemoglobinemia, one cause of infant mortality? A survey of soil and water in southern Minnesota explored the possible relationship.

Soil Nitrification and Nitrates in Waters

By EDWIN L. SCHMIDT, Ph.D.

VERY young infants, usually less than 2 months old, may acquire methemoglobinemia as a result of ingesting water high in nitrates. The ingested nitrate may oxidize a portion of the hemoglobin to methemoglobin with consequent loss in oxygen transport and oxygen exchange in the blood; if severe, the anoxemia may produce serious effects, and death may occur.

Cases of methemoglobinemia induced by well waters high in nitrates have been reported principally in the midwestern United States and the central Provinces of Canada (1, 2). Although the high nitrate content of most of the wells studied apparently was associated with nearby sources of pollution, the origin of the nitrates that accumulate in ground waters was not always clear (2). Several writers have suggested that nitrate formation in normal agricultural soils may contribute significantly to nitrate accumulation in rural well waters (1, 3-5). This suggestion merits further consideration, since the peculiar geographic distribution of the disease in the United States corresponds roughly to the belt of highly productive Chernozem and Prairie soils.

Nitrates are found in soils as a result of the activities of the soil microflora. Nitrogen reaches the soils principally in organic form as

a part of plant and animal residues, and in this form it is subject to attack by a large and diversified group of soil micro-organisms. As the result of microbial action the nitrogen added originally in organic complexes is transformed into new organic combination as a constituent of microbial protoplasms, and the excess beyond cell needs is converted to the inorganic ammonium form. A first prerequisite of high nitrate production is the occurrence of nitrogen in the ammonium form.

Ammonium nitrogen is transformed rather rapidly under appropriate soil conditions by the activity of the specific autotrophic nitrifying bacteria of the genera *Nitrosomonas* and *Nitrobacter*. These organisms derive their energy, respectively, from the oxidation of ammonium to nitrite and the oxidation of nitrite to nitrate. Many soil factors influence the activity of the nitrifiers, but it is well established that the most fertile soils generally promote the most active nitrification.

To obtain information regarding the possible relationship between nitrate accumulation in waters and nitrate production in soils associated with those waters, a survey of soil nitrification was undertaken in the methemoglobinemia region of Minnesota in 1951. This survey was made possible by a grant from the Minnesota Department of Health.

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Organization of the Survey

The areas included in the survey were located in Renville, Nobles, Rock, and Mower Counties

of southwestern and south central Minnesota. The first three of these are among the counties in the State that reported the largest number of methemoglobinemia cases in the period 1947-49, according to the report of Rosenfield and Huston (5). Mower County is about 100 miles east of the principal methemoglobinemia region described in that report.

Starting points for studies in each county were selected on the basis of records on file at the Minnesota Department of Health. Each initial site was a farm that, according to the health department's field studies of infant methemoglobinemia, had a high nitrate water supply. Following the survey of the initial site, additional sites in the same section and in adjoining sections were examined.

The survey of a given site centered about the water supplies of that site. In addition to farm wells, field tile drains that were carrying water, rural school wells, springs, and streams in the vicinity were included in the survey. A qualitative test for nitrate, with diphenylamine solution, was made at the site. Information was sought concerning such features as location, depth, construction, and use of farm wells; topography and surface drainage; the location of waste organic nitrogen accumulations; and land use practices. A sample from each water supply was collected for subsequent laboratory analysis. (Laboratory analysis of water samples was done by the Minnesota Department of Health.)

Soils in the vicinity of the water supplies were observed for topography and land use. Sites for sampling were selected so as to reflect the variations in soils. The usual practice was to obtain samples within a 50-foot radius of the water supply and to supplement these with samples collected from the various soils 100 to 500 feet from the water supply. Composite samples of surface soil, made up of from 4 to 6 subsamples, were taken from the 0- to 6-inch soil layer, and corresponding subsoil samples were taken at a depth of 30 to 36 inches with a soil auger.

The nitrate content of the soil and water samples returned to the laboratory was determined quantitatively by standard methods using phenoldisulfonic acid (6, 7). (Nitrate is

measured and reported as parts per million nitrate nitrogen, or $\text{NO}_3\text{-N}$, which denotes the amount of nitrate in terms of its nitrogen.) The nitrifying capacity of each surface soil sample was determined by conventional methods of soil microbiology (8). Each soil was rated low, medium, high, or very high in nitrifying capacity on the basis of the quantity of nitrate produced by 100 gm. of soil incubated in the presence and in the absence of added ammonium nitrogen during a 6-week period. Solution culture studies using each surface soil as an inoculum provided additional data in rating the nitrifying capacity of each soil. Soils rated low produced less than 3 p.p.m. nitrate nitrogen during incubation for 6 weeks in the absence of added ammonium nitrogen and less than 35 p.p.m. nitrate nitrogen when 30 mg. ammonium nitrogen had been added. Soils rated very high produced more than 100 p.p.m. nitrate nitrogen without added nitrogen and more than 700 p.p.m. nitrate nitrogen in the presence of added nitrogen.

Results and Discussion

Almost all of the wells examined were of dug or bored construction and were relatively shallow, generally 15 to 50 feet deep. Exceptions to these characteristics are noted in the tables.

The concentrations of nitrate found in the waters sampled and in soils in the vicinity of the water supply are listed in tables 1, 2, and 3. (Data for soil samples taken beyond 50 feet from the water supply are not given, since these samples numbered only 7 for surface soil and 6 for subsoil.) The nitrate content of the soils varied greatly within a short distance, and the same soil varied considerably with the time of sampling. Nitrates in the surface soil maintained no constant relation to the nitrates in the parent material (subsoil samples) of that soil. There was no relation between the nitrate content of the water and that of the soils at the time of sampling. The variations in soil nitrate content are to be expected, since the nitrates that are produced in the surface soil are subject to leaching by rainfall and to utilization by microorganisms and higher plants.

The data on nitrate concentrations must be

considered in connection with certain conditions at the time of sampling. The first sampling in Renville County, in early July, followed a period of about 3 weeks of abnormally heavy rainfall. The excess rainfall had caused standing water in some fields, drowned-out areas in corn, alfalfa, and bean fields, and a water table within 30 inches of the surface in many places. At the time of the second sampling, late in August, more normal conditions of rainfall prevailed. Both rainfall and crop development conditions were altered markedly between sampling periods. The nitrate content of the water supplies was lower and that of the surface soils was higher at the time of the second sampling. It is likely that the high rainfall prior to the initial sampling leached large quantities of nitrates from the surface soil at a stage of crop development that made relatively small nutritional demands on the nitrates of the soil. Much of the nitrate washed from the surface soil might well have contributed to that of the ground water supply.

Similar variations with rainfall conditions were observed in Rock and Nobles Counties, although the nitrate concentrations fluctuated less. In these counties, initial samples were taken after several weeks of near normal weather, whereas the second samples were taken soon after a short period of heavy rainfall. The variation noted in the nitrate content of the same well water is in agreement with the observations of Siemens and Mallett (9).

The data concerning the relationship between the nitrifying capacity of the soils and the nitrate concentration of the water supplies near those soils are summarized in table 4. The water supplies are grouped according to their nitrate content.

Soils that were obviously contaminated with organic nitrogen by livestock had the highest nitrifying capacities. These soils represented barnyards or the feeding lots so common in southwestern Minnesota or areas that so closely adjoined them as to be influenced by the organic nitrogen present. As can be seen in table

Table 1. Nitrate content of water supplies and of nearby soils in Renville County, Minn.

Site	Water supply	Date sampled in 1951	NO ₃ N in water (p.p.m.)	NO ₃ N in soils within 50 feet of water supply (p.p.m.)	
				Surface	Subsoil
1	Farm well A	July 9	120	6	23
	Farm well B	Aug. 23	92	212	(²)
	Field tile	July 9	54	7	19
		Aug. 23	29		
2	Farm well	July 9	18	12	6
		Aug. 23	4	13	5
3	Farm well	July 10	75	44	14
	Field tile	July 10	10	8	15
4	Farm well	July 10	12	10	2
		Aug. 23	6	29	3
5	Farm well	July 10	87	4	2
	Pasture well	Aug. 24	46	67	
6	Farm well	July 10	(¹)	6	2
		Aug. 24	1.0	11	58
7	Farm well	July 10	35	18	4
	School well	Aug. 24	8	69	7
8	Farm well A	July 10	9	10	12
	Farm well B	July 11	1.0	2	2
26	Farm well	Aug. 24	70	8	5
	Farm well	Aug. 24	16	45	7
27	Farm well	July 11	4.0		
		Aug. 24	1.0	71	11
		Aug. 24	8	16	5
		Aug. 24	1.0		

¹ Under construction. ² Lost.

4, water supplies with the highest concentrations of nitrate were located near soils of very high nitrifying capacity. At all but one of the sites in this group, the very high nitrifying capacity of at least one soil near each water

supply was due to a concentration of organic nitrogen. At that one, site 8, no effect of organic nitrogen contamination was readily apparent, although a hog-feeding area within 150 feet of the water supply existed a few years

Table 2. Nitrate content of water supplies and of nearby soils in Rock County, Minn.

Site	Water supply	Date sampled in 1951	NO ₃ N in water (p.p.m.)	NO ₃ N in soils within 50 feet of water supply (p.p.m.)	
				Surface	Subsoil
11	School well	July 31	1.7	19	2
	{ Farm well A	{ July 31	13	247	2
12	Farm well B	{ Sept. 13	22	121	-
	{ Farm well C ¹	July 31	26	30	2
13	Farm well D	July 31	1.0	8	2
	{ Field tile	{ July 31	15	11	2
14	Farm well	{ Sept. 13	23	7	2
	{ Farm well ²	Sept. 13	6.2	10	-
15	Farm well	July 31	80	20	25
	{ Pasture well	{ Sept. 13	100	15	80
16	Farm well	Aug. 1	2.3	33	32
	{ Farm well A	Aug. 1	6.3	10	2
28	{ Farm well B	Aug. 1	4.4	14	2
		Sept. 13	130	138	-
		Sept. 13	62	19	42

¹ Drilled well, 260 feet deep.

² Drilled well, 130 feet deep.

Table 3. Nitrate content of water supplies and of nearby soils in Nobles and Mower Counties, Minn.

Site	Water supply	Date sampled in 1951	NO ₃ N in water (p.p.m.)	NO ₃ N in soils within 50 feet of water supply (p.p.m.)	
				Surface	Subsoil
Nobles County					
10	Spring	Aug. 2	6.4	14	6
17	{ Farm well	{ Sept. 14	8.5	19	-
	{ Pasture well	Aug. 1	4.4	28	-
18	School well	Aug. 1	4.8	44	2
	{ Farm well	{ Sept. 14	1.0	6	2
19	Field tile	Aug. 2	1.5	12	2
	{ Spring	Aug. 2	40	20	2
		{ Aug. 2	5.2	63	-
		{ Sept. 14	4.1	20	8
			4.2	6	3
Mower County					
20	School well	Aug. 16	1.0	7	2
21	Farm well	Aug. 16	18	38	18
22	School well	Aug. 16	1.0	11	2
23	Farm well	Aug. 16	1.0	13	3
25	Farm well	Aug. 16	1.0	8	2

Table 4. Nitrate content of water supplies in relation to their location and to the land use and nitrifying capacity of nearby soils

Site	Water supply	NO ₃ -N in water (p.p.m.)		Location with respect to possible pollution ¹	Soils of vicinity	
		First sam- pling	Second sam- pling		Land use	Nitrifying capacity
Water supplies of high NO ₃ -N						
1-----	Farm well A-----	120	92	Poor-----	Barnyard----- Sod----- Cultivated-----	Very high. Low. Low.
2-----	Farm well-----	75	-----	Poor-----	Near barnyard-----	High.
4-----	Farm well-----	87	46	Poor-----	Barnyard----- Cultivated-----	Very high. High.
8-----	Farm well A-----	70	16	Questionable-----	Cultivated----- Sod-----	Medium. Very high.
13-----	Farm well-----	80	100	Poor-----	Barnyard-----	High to very high.
28-----	Farm well A-----	-----	130	Poor-----	Barnyard-----	Very high.
Water supplies of moderately high NO ₃ -N						
1-----	Field farm well B----- Field tile-----	54	29	Questionable----- Good-----	Sod----- Cultivated-----	Low. Medium.
3-----	Field tile-----	18	4	Good-----	Cultivated-----	Medium to high.
5-----	Field tile-----	12	6	Good-----	Cultivated-----	High.
12-----	Farm well----- (Farm well A----- (Farm well D-----	35	8	Good----- Poor----- Good-----	Cultivated----- Barnyard----- Sod-----	High. High. Medium to high.
19-----	Farm well-----	13	22	Poor-----	Cultivated-----	Low.
21-----	Farm well-----	15	23	Good-----	Sod-----	Very high.
21-----	Farm well-----	40	-----	Questionable-----	Cultivated-----	Medium.
Water supplies of low NO ₃ -N						
3-----	Farm well-----	10	-----	Questionable-----	Sod-----	High.
6-----	Farm well-----	9	-----	Poor-----	Near barnyard-----	Very high.
10-----	Spring-----	6.4	8.5	Good-----	Cultivated-----	Low.
11-----	School well-----	1.7	-----	Good-----	Sod----- Cultivated-----	High. Low.
12-----	Field tile-----	-----	6.2	Good-----	Cultivated-----	Medium.
14-----	Farm well ² -----	2.3	-----	Poor-----	Barnyard-----	Medium.
15-----	Farm well-----	6.3	-----	Good-----	Cultivated-----	Low.
16-----	Pasture well-----	4.4	-----	Questionable-----	Sod-----	High.
17-----	Farm well----- (Pasture well-----	4.4	-----	Poor----- Questionable-----	Barnyard----- Sod-----	Very high. Low.
18-----	Pasture well-----	4.8	-----	Questionable-----	Sod-----	Low.
18-----	School well-----	1.0	1.5	Good-----	Sod-----	Low to medium.
19-----	(Field tile-----	5.2	-----	Good-----	Cultivated-----	Medium.
26-----	Spring-----	4.1	4.2	Good-----	Cultivated-----	Medium.
26-----	Farm well-----	-----	8	Questionable-----	Sod-----	High.
Water supplies of very low NO ₃ -N						
5-----	Pasture well-----	-----	1.0	Good-----	Sod-----	Medium.
7-----	School well-----	1.0	1.0	Good-----	Sod-----	Medium.
12-----	Farm well C ³ -----	1.0	-----	Good-----	Cultivated-----	Low.
20-----	School well-----	1.0	-----	Good-----	Sod-----	High.
22-----	School well-----	1.0	-----	Good-----	Sod-----	Medium.
23-----	Farm well-----	1.0	-----	Good-----	Sod-----	High.
25-----	Farm well-----	1.0	-----	Good-----	Sod-----	High.
27-----	Farm well-----	-----	1.0	Good-----	Sod-----	Medium.

¹ Location of the water supply was evaluated on the site. Sites classed as "poor" were located within a hundred feet of obvious concentrations of organic nitrogen. Those classed as "good" were sites well removed from any concentrations of organic nitrogen. Those sites classed as "questionable" usually were within several hundred feet of manure piles or barnyards. ² Drilled well, 130 feet deep. ³ Drilled well, 260 feet deep.

ago. Sites 6 and 17 illustrate that large concentrations of organic nitrogen in the soil adjoining a well are not necessarily reflected in a high nitrate content for that well.

Of primary interest in this study was the question of whether or not the normal field soils—the agricultural soils uncontaminated by heavy additions of organic nitrogen—might contribute to the nitrates that accumulate in the well waters of the methemoglobinemia region. The data in table 4 throw some light on this question.

The nitrifying capacity of soils other than those designated as "barnyard" ranged from low to very high. Only one of these soils, at site 8, was rated very high, and, as has already been noted, it is possible that this soil was contaminated by concentrations of organic nitrogen formerly in the vicinity. The soils of the region of Minnesota surveyed were highly productive when first placed in cultivation less than a hundred years ago. The high native fertility was due in large part to the high organic content of the soils. The effect of continued cultivation involving both good and bad land-management practices would be expected to influence the nitrifying capacities of the soils by virtue of influencing the kind and quantity of organic nitrogen present. Many of the normal soils examined demonstrated a high nitrifying capacity. The laboratory measurements of soil reaction and the field observations on the organic matter content and texture of the soils further support the conclusion that many of the soils of the region are capable of producing substantial quantities of nitrates. The addition to such soils of organic nitrogen in the form of manure fertilizers or accumulated waste from livestock will result in the very high nitrifying capacity found in the barnyard soils.

The nitrate content of certain of the waters associated with the normal field soils of medium to high nitrifying capacity is of marked interest. The data in table 4 for field tile drains reveal that drainage waters directly influenced by soil nitrification contained as much as 18 p.p.m. nitrate nitrogen. At site 5, where the direct contribution of soil nitrification was more difficult to assess, a well contained 35 p.p.m. nitrate nitrogen despite its location far from any con-

centrations of organic nitrogen. This well served only a home, and no farm buildings were within one-half mile. The cultivated field adjoining the well had a high nitrifying capacity, and it is considered likely that soil nitrification was the important factor concerned in the nitrate content of the well water at the time of the initial sampling.

None of the samples of stream or ditch water examined showed evidence of nitrate accumulation. The streams proved to be a poor index of generalized nitrate production in the areas sampled probably because the heavy algal growth in the streams kept the supply of available nitrogen low.

Summary and Conclusions

In connection with a survey to investigate the possible relation between nitrate production in soil and nitrate concentration in waters, data on 39 water supplies from 26 sites in 4 counties of Minnesota were obtained. Samples of 59 surface soils and 50 subsurface soils associated with these waters were studied in the laboratory for nitrate content. The surface soils were also studied for capacity to produce nitrates. Laboratory data on the water and soil samples were interpreted in the light of field observations.

The 16 water supplies that were sampled a second time during the summer gave evidence that the nitrate content of the water supplies fluctuated significantly during a 5- to 6-week period. These fluctuations were considered to be due largely to soil leaching associated with the rainfall distribution. Changes in the nitrate content of the surface soils correlated well with changes in the nitrate content of the water supplies. The nitrifying capacities of the soils remained essentially constant for the two samplings.

Soils obviously contaminated with organic nitrogen by livestock had the highest nitrifying capacities. The water supplies with the highest concentrations of nitrate (75 to 130 p.p.m.) were located near such soils. However, not all water supplies near contaminated soils had unusually high nitrate content.

Normal field soils in pastures, sod, or under

cultivation near the very high nitrate waters were generally much lower in nitrifying capacity, but many of the normal field soils exhibited high nitrifying capacity despite the absence of abnormal additions of organic nitrogen. Such field soils were associated with subsoil drainage waters of up to 18 p.p.m. nitrate nitrogen and well waters of up to 35 p.p.m. nitrate nitrogen.

The rich soils of southwestern Minnesota present nearly ideal conditions for soil nitrification, limited normally by the release of ammonium nitrogen from the soil organic matter. Pollution of these soils with nitrogenous wastes will provide an excess of ammonium nitrogen and result in extremely high nitrate production. It seems possible that such soils of very high nitrifying capacity may sometimes contribute to the nitrate content of water supplies ordinarily considered to be satisfactorily located. Further study of the relation of nitrification to the accumulation of nitrate in waters will be necessary before any definite conclusions can be drawn.

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Fluoridation of Public Water Supplies

The Supreme Court of Oregon on January 11, 1956, in the case of *Baer v. City of Bend*, confirmed the decree of the circuit court which had sustained a demurrer to the complaint brought to enjoin city officials from fluoridating the Bend water supply.

The plaintiff contended that fluoridation would deprive him of his liberty without due process of law secured by the 14th amendment and encroach on his freedom of religion secured against Federal intrusion by the first amendment and similarly secured against State intrusion by the 14th amendment. The court, noting the various cases and other authorities (and the express concession of the plaintiff that dental health is a proper field for the exercise of State authority), held that the fluoridation measure of the city of Bend was a reasonable law for the protection of the public health and did not violate any religious or other liberties guaranteed by the Constitution.

A review and appraisal of behavioral science self-surveys by five universities in the light of their value for medical social workers.

The Behavioral Sciences and the Professions

By DAVID G. FRENCH, M.Sc.

THE CONTRIBUTION of the social sciences to the practicing professions has received increasing attention since World War II. That concentrated investment in mutual destruction produced, ironically, a major impetus to the science of human behavior and relationships. None of the "helping professions" today is without its contingent of members who advocate infusing professional knowledge and practice with social science theory and research.

There are, however, serious obstacles to effective collaborative work. The patterns evolved in the physical and biological sciences for relating basic and applied research do not apply directly to the field of human behavior and human relations. The social sciences are in about the 17th century in their development relative to the natural sciences. Yet the very fruitful division of labor between theory-focused and practice-focused research which has been evolved between the natural sciences and their related fields of application continues to challenge social scientists and social practitioners.

Mr. French is executive secretary of the Coordinating Committee on Social Welfare Research at the University of Michigan and lecturer in the School of Social Work at the university. The original of his paper was presented at the 82d annual forum of the National Conference of Social Work, San Francisco, May 29-June 3, 1955. The 1956 forum will be held in St. Louis, May 20-25.

A stimulating analysis of practice-science relationships in the social field is one of the outcomes of the surveys of the behavioral sciences conducted at Chicago, Harvard, Michigan, North Carolina, and Stanford Universities during 1953-54 under the sponsorship of the Ford Foundation. The surveys have been reported in administrative documents issued separately by the universities (1-5). Of particular interest to medical social workers and others in the health field is the survey conducted at Harvard. The Harvard Survey Committee included six professional schools in its study: medicine, public health, dentistry, business administration, education, and law. I have drawn on the Harvard survey particularly in preparing this review. The Michigan survey also included a particularly useful discussion on the utilization of the behavioral sciences in the professional fields.

One cannot read these documents without becoming aware of the striking similarity of the problems which physician and industrialist and lawyer and social worker encounter in seeking to make use of social science theory and research. This similarity stimulated the present attempt to identify common elements in the relationships of professional fields and the behavioral sciences and to suggest some of the conditions for effective collaborative work.

A parenthetical note is in order before proceeding to this review. For purposes of this paper the distinction between the behavioral sciences and social sciences is not important. Behavioral science is the term which the Ford Foundation has adopted to cut across the con-

ventional divisions of knowledge concerned with individual behavior and human relations. The term thus makes it possible to exclude portions of political science, for instance, which are historical or philosophical and to include work going on in biology, geography, or law. Behavioral science cuts across the present organization of academic fields, but, in spite of this, coincides to a large extent with the subject matter of the traditional social sciences. The term social science is used throughout this paper except when the term behavioral science appears in a quotation or refers to the surveys.

The General Atmosphere

A reading of the behavioral science survey reports brings out a fundamental difference between the social sciences and the professions which can be expressed best as a difference in atmosphere or climate. There are three ways the difference in climate is expressed.

The first has to do with the premium placed on action in the professions as contrasted with development of knowledge in the social sciences.

In discussing the law school, the Harvard committee wrote, "The lawyer is attuned to the pressure for relatively immediate practical action. Many social scientists . . . resist being drawn into the vortex of action responsibility. . . . A social scientist . . . is likely to be interested primarily in the struggle for adequate noncontradictory generalizations. . . . The lawyer, on the other hand, is likely to be interested in general descriptive theory primarily insofar as it yields a clue to the solution of particular problems demanding action" (2a).

The subculture of all the professions is action oriented. The subculture of the social sciences is oriented toward analysis and explanation. This difference in climate has to be recognized in understanding the interaction processes of persons who come from the diverse backgrounds of science and practice.

Another difference in climate has to do with the deeply ingrained anti-bureaucratic, anti-hierarchical attitude of the social scientist and the ready adjustment of the professional to administrative policies and channels and to organizational requirements.

The mere conduct of the behavioral science surveys was seen as a threat by the social scientists. One social scientist at Harvard said, "The philosophy, in part, behind [these surveys] appears to be that science and scientific investigation can be channelized, organized, or even evaluated. Taking the latter, I know of no objective criteria for establishing whether a given project in basic research is 'good,' 'sensible,' 'useful,' 'worthwhile,' or even 'sane'" (2b).

Another one said, "I'm afraid you might come to some conclusions about the areas of potential growth in social science. I feel the area of potential growth lies exclusively in a genius having a new idea" (2b). This is typical of the academic individualism which prevails in the basic social sciences.

Viewed ideally, the university is a community of scholars who are roughly equal in authority and who are self-directive and self-disciplined (6). In contrast to this there is a comparative absence of the ideal of equalitarian anarchism in the professional schools. In the Harvard business school, the survey committee commented, "It is interesting to note that there have been no expressions of outright faculty opposition to central administration of the research program by the Division of Research" (2c). On the contrary, there were suggestions as to how the Division of Research, which presently "administers" the research program in the school and does not "direct" it, could be strengthened as a facilitating, coordinating, and planning unit.

In the Harvard Medical School the doctors found the anti-organizational bias of the social scientists puzzling and troubling. The physician is accustomed to being responsible to the patient and the hospital and to his colleagues and has difficulty accepting the social scientists' preference for a free scholarly approach.

The typical problem in a professional field is likely to cut across a number of scientific disciplines, and a group approach is frequently essential. Persons involved in establishing group research projects had better be sensitive, however, to the social scientist's resistances to having his work organized and made subject to an administrative hierarchy.

So much for climate. Additional differences

could be noted, but the point here is that climate does differ, and special attention to problems of acclimatization is required if the social scientist or practitioner is to survive and be useful in an alien setting.

Differences in Goals

Now, as to differences in goals, the typical goal of the social scientist is development of adequate laws or generalizations or theories to account for the portion of the world that he studies. The typical goal of the practitioner is knowledge as a guide to actions for which he is responsible. This statement implies a black-and-white contrast between science and practice, but it should be understood that there are various shadings of gray in the actual way in which a particular social science or profession may present itself. Some of the social sciences are much "purer" than others in the sense of seeking knowledge for the sake of knowledge. There is considerable variation between campuses in this regard. The committee at Harvard concluded that, on the Harvard campus at least, "the balance seems definitely to favor the pursuit of knowledge for its own sake" (*2d*).

Just as theory rather than application takes priority in the social science disciplines, so does research methodology become a goal which is seen as worth while in itself. This acceptance of tool development as a worthwhile goal in itself is seen perhaps most clearly in the strong support expressed in several of the surveys for strengthening the field of mathematical statistics. The attitude reflects a division of labor in social science which is so taken for granted it is not always explained or justified.

However, there are some dissenting voices in the social sciences themselves with respect to methodological preoccupations. One Harvard social scientist commented that social scientists are more preoccupied with ways of thinking about problems than in actually working on them (*2e*). And another one quoted approvingly a comment of Freud's to the effect that there comes a time when you ought to stop cleaning your spectacles and take a look through them (*2f*). All of this simply underscores the fact that between the black-and-white contrasts

being pointed up here, there are important shades of gray.

Perhaps one other difference in the goal of the social sciences and the professions is worth noting. In the professions, the object of research is not simply the condition being treated, whether it be a disease or a falling profit rate or the breakup of a family. The practitioner is interested in the facility for treating the condition. In the medical social work field, this means the physician and hospital, the medical social worker, and the various resources that can be called into play in working with the patient. Action must always be guided by understanding of both the condition and the treatment. To the scientist, however, the treatment may appear too variable to lead to knowledge of general significance, and it will not be the focus of his research as frequently as the condition being treated.

So much, then, for differences and similarities in goals. The differences appear, we must recall, at the point where two activities which are seeking to maintain their institutional identities come together. Seen from a broader view, the goals of the professions and the social sciences are unified within the broad societal goals which form the ground within which a division of labor has taken place.

The Methods of Science and Practice

There are just two contrasts between the methods or procedures of the social sciences and professions which I want to report to you from the surveys made of the social science departments and professional schools. One is the widespread use of the case method in all the professional schools, but particularly law and business administration. The stress on the case method reflects, I think, the basic caution of the practitioner about the danger of the "trained incapacity" of the social scientist, to borrow one of Thorstein Veblen's terms. That is, the social scientist, by focusing on that portion of reality which is abstracted and brought into focus by theory, may obscure the larger context of the object of study.

An interesting instance of this came up in a discussion between a sociologist and social casework teacher at the University of Michigan

during one of the discussions of a faculty seminar on the research basis of social welfare practice. This seminar participated in the behavioral science survey at that university. The sociologist had reviewed the findings that had been developed in social psychology about the effect of class status on the way a child responds to frustration. He then wanted to know why material of this kind could not be organized systematically and taught to social work students in place of the time-consuming and unsystematic method of case teaching. The casework teacher finally traced her reluctance about following such a procedure to her concern lest students see class status as the only or primary factor in the child's reaction to frustration instead of as one of several forces operating in the child's experience.

The case method of teaching assures that generalizations and theories such as those about the influence of class status will always be seen in the context of the total life experience of the individual. Professionals always have to take into account the total situation which falls within the province of their particular service, not just a conveniently circumscribed aspect of it. This is probably one of the important reasons for the retention of the case method in law, in business, and in social work even as knowledge has become better organized and systematized.

The other characteristic method of the professions, as contrasted with the social sciences, in carrying on their research and educational work, is an intimate and continuing interaction with the applied field. The Harvard Law School's Committee on Legal Education said on this point, "[This professional nexus] is the only practicable insurance against getting lost in intellectual blind alleys. The scholar who isolates himself from the practice of his profession easily confuses what is intellectually challenging with what is really significant in human affairs" (2g). Now to the social scientist, exposure to and involvement in the complex and practical concerns of a profession is a hazard and may subvert his ability to make his peculiar contribution. Isolation from the concerns of a profession, on the other hand, is a hazard to the professional and may render his contribution peripheral or irrelevant.

There are many more characteristics of the social sciences and the professions which are pointed up in the behavioral science surveys. I have not attempted a systematic cataloging of them but have selected those which I think are particularly relevant to the situation of medical social work and the social sciences. The question now comes, what are the implications of this review for research and teaching in medical social work?

Suggestions for Collaborative Work

Several general suggestions for collaborative effort can be found in the survey volumes. Before reviewing these, it is worth noting the expressions of conviction about the worthwhile-ness of collaborative work. A visiting committee of scholars from other universities, which was assigned the task of reviewing and commenting on the report at Harvard, wrote: "The net impression is imparted that collaboration is fraught with very great difficulties. Its advantages are so great, however, that we wish to express our belief that the gains are worth the costs" (2h).

From the University of Michigan Survey Committee comes this appraisal of the need for more active collaboration between professional schools and social science departments: "The professional school staff member is likely to be intimately acquainted with the history and the current institutional factors in the field situation. This rapport with administrators and practitioners in the field gives him valuable insights into relevant problems and variables. Those behavioral scientists whose work requires a field setting will undoubtedly find it desirable if not necessary to work in collaboration with professional school faculty who may approach the same substantive situations with somewhat different interest" (3).

A wholesome warning not to exhaust one's energies in looking for the best pattern for relating professional practitioners and social scientists is given in the Harvard report. The Harvard committee observes that the organizational formula which might insure fruitful research remains, like the philosopher's stone, undiscovered. Formulas put forward eagerly by one or another exponent of science in prac-

tice are suspect in any case. The fact is that collaboration remains more of an art than a science and must be played by ear if errors are to be corrected as they appear.

Nevertheless, considerable wisdom about collaboration between the sciences and fields of practice is embodied in the surveys.

The first point I wish to report is the consensus in these behavioral science surveys that the adaptations of science to the professions must take place in the professional schools. For social work, this means the application of the various behavioral sciences to social work problems will not come about if dependence is placed on departments of psychology, economics, or sociology to do this work. It must be done within and by the professional schools themselves.

The School of Education at Harvard provides an example of a bold approach to this problem. Some years ago the Harvard School of Education established the laboratory of human development and brought in a psychologist to head it. Its present head is an anthropologist. The laboratory was designed as a social science research center, not as a research service available for teachers and school administrators. The problems selected for research are those seen by the scientists as important and amenable to research with the theory and methodology available in the sciences.

Noting the heavy emphasis which has resulted on basic rather than applied problems, the Harvard committee states: "Some might feel that the School was neglecting its responsibilities to the educational profession by taking this position. It is felt, however, that more applied problems will eventually be more adequately solved if they are attacked with the methods and assumptions which have been developed by basic research, than if they are approached on an ad hoc basis. It is possible that this policy of the school will result in the neglect of more applied problems and too much emphasis on basic research, but the behavioral scientists on the staff do not think it will" (*2i*).

Every profession would be strengthened if a few of its professional schools set themselves the long-range task which the laboratory of

human development at Harvard has set for itself. It is worth noting that this research center is organized around one component in the educational process: the child. Other components such as the organization of the school system, the selection and training of teachers, and so forth, will need to be met with other research resources.

The surveys contain examples of other models for incorporating behavioral scientists into the professional schools. The School of Business Administration at Harvard provides us with a case in point.

A committee in the School of Business Administration expressed concern lest a scientific approach result in singling out one part of a problem, and underscored heavily the importance of seeing and weighing all the facets of a problem in the practice of business administration. The committee writes: "It is this recognition of the multidimensional character of the problems of business administration which has led to the belief at the School that the adaptation of the basic disciplines of the behavioral sciences to the problems of business administration must be made here at the School, rather than by various groups of behavioral scientists themselves. Each problem must utilize knowledge, insights, and techniques of analysis derived from more than one of the behavioral and social sciences" (*2j*).

How to tap the contributions of the social sciences for business administration? A number of procedures are suggested, but perhaps the crucial one is this: "There is need to add to the permanent faculty a few men thoroughly trained in the range of behavioral sciences embraced by the Social Relations Department who would serve as focal points in the faculty to assist in the adaptation of these fields to the problems of business administration" (*2k*). Note that it is assumed the men brought in will remain social scientists and not become experts in business administration. But their attention will be focused on the problems of business, and their research will draw heavily on the business setting for its data.

Of course, the presence of social scientists in a professional school will not affect theory and practice in the field through some mysteri-

ous process of osmosis. Provision must be made for collaborative work on the part of social scientists and professionals in concept formulation and research and writing. The committee in the Harvard business school wrote on this point: "The School has recognized that research is essentially a full time activity. The School has set forth as a goal, therefore, that each member of the faculty can have the equivalent of one year in three free from instruction responsibility to engage in research" (2l). This is an ambitious goal. It is based, however, on a realistic appraisal of the investment required in time and energy from the field of practice if collaborative work between practitioner and social scientist is to bear fruit.

Another way to achieve a setting for productive collaborative work between social scientists and members of professional schools is the device of dual appointments. A social scientist is given faculty status both in his own discipline, thereby protecting his own career line, and in the professional school, thereby giving him an identification with the profession and its goals. This arrangement is already in effect in several universities and no doubt has value.

If we turn to the health field, both medicine and public health, we find in the Harvard report numerous statements indicating uncertainty as to the best procedures for fostering collaborative effort. The committee states: "We are unwilling at this juncture to make specific permanent recommendations with regard to integration of behavioral scientists in the health area. There are a number of fundamental issues which involve both the behavioral sciences and the health schools on which policy decisions must be made on both sides before any sort of organizational change could be reasonably advocated" (2m).

Of the several factors one can look for in the Harvard report in explanation of this uncertainty, the underlying one seems to be the self-sufficiency of medicine and the extremely effective indoctrination which medical education is able to achieve with respect to the goals and the methods and the theory of medical care. The committee encountered extensive ignorance about the social sciences in the medical school faculty, and many doctors saw no difference be-

tween the role of social scientists and trained social workers. There were some who had strong feelings that the social scientist was not really scientific, failed to understand the problems of the physician, and did not accept the type of responsibility which seems natural to the physician.

The social scientists, on the other hand, saw the doctor committed to short-term goals which made difficult the conduct of research that did not have an immediate pay-off. Also they found that the doctors tended to insist on administrative "control" of projects, thus threatening the integrity of the research as seen by the social scientist.

Out of this analysis of the problems of research in the health setting, the Harvard committee came up with a proposal that parallels almost exactly the proposal which the Michigan faculty seminar on the research basis of social welfare practice, referred to earlier, developed with respect to the field of social work. Let me quote:

"The experience of the committee in preparing this report has made patent the need for a forum in which the study of human behavior in relation to medicine can be continued. . . . It is recommended that a standing committee drawn from the faculties of the Schools of Public Health and Medicine with appropriate representation from the Faculty of Arts and Sciences be established. The nucleus of the committee would consist of an executive secretary and sufficient clerical help to enable it to function continually. As conceived, the committee would in no sense make policy or act as an authoritarian body but would exist primarily as an interfaculty study unit and consulting service . . ." (2n).

Essentially, the approach arrived at by the Harvard committee and the Michigan faculty seminar is to avoid elaborate administrative machinery and to provide, instead, staff service and research funds to stimulate cooperative work between interested behavioral scientists and interested members of the professional school faculty. No centralized direction of research effort is contemplated, but instead a building on existing interest and strength. The approach rests on the faith that the best way

to define problems and plan research is to do research. Regardless at what point one starts, an encounter with the data brings to the fore the salient problems and directs research effort along these lines.

Conclusion

The kind of surveys sponsored by the Ford Foundation and carried out by the five universities are valuable and have their place. They are an excellent first step in establishing communication and in identifying common interests and goals. Not until research is under way, however, not until particular social scientists and particular members of practicing professions sit down together to design research and collect and analyze data, will we be able to answer the kinds of questions which caused the Harvard committee to refuse to make specific recommendations as to how to integrate the social sciences and the health professions.

Medical social work is in a strategic position in many respects to work out and demonstrate effective ways of bringing the specialized approaches of the behavioral sciences to the problems of practice in both the health and welfare fields. Medical social workers know their way around the health field; they are aware of the subculture of the hospital and clinic;

and they share the same sense of responsibility as does the medical doctor with respect to the patient. At the same time, the primary focus of the medical social worker is the same as that of the social scientist: individuals and institutions and their interaction.

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Application Deadlines Waived

Deadlines for filing applications for research grants for studies of limited scope and size have been waived by the National Institutes of Health of the Public Health Service in order to provide rapid and flexible support for meritorious, limited studies. As of March 21, 1956, the usual deadlines of March 1, July 1, and November 1 have been waived, on an experimental basis, for about one year.

Types of applications still subject to "regular deadlines" are those that request more than \$2,000 plus indirect costs or request more than

one year of support or supplements to existing grants or applications.

Other policies and rules governing applications remain in force. If more extensive support should be required to continue the studies initiated, the investigator should apply for a grant according to the usual deadlines. Grants are not intended to support research typically designed for writing a thesis.

All applications as well as requests for forms or information should be addressed to the Division of Research Grants, National Institutes of Health, Bethesda 14, Md.

Trends in Brucellosis Control

By K. F. MEYER, M.D.

BRUCELLOSIS is a world health problem ranking near the top of the ever-lengthening list of infections transmitted from animals to man in its effect on human and animal health and in its economic importance (1-4). Unfortunately the extent of its prevalence in large areas of the world is virtually unknown. The number of reported cases in human beings undoubtedly does not represent the number of cases that occur. This infection directly affects large segments of the agricultural population and other exposed groups through prolonged illness and reduced capacity for work. These burdens fall particularly heavily on Latin American and Mediterranean areas where the prevalence of *Brucella melitensis* in goats is high.

Epidemiology

Most of the infections result from direct contact with post birth discharges, fetal membranes, and fetuses from infected animals when they give birth or abort, or from contact during slaughter. A significant number of patients

also acquire it through ingestion of dairy products from infected cattle and goats.

The three species of *Brucella* known to infect man—*abortus*, *melitensis* and *suis*—resemble each other so closely that they can be distinguished only by special tests. Probably these three species descended from a common bacterial ancestor and acquired special characteristics on adaptation to a new host. The fairly balanced relationship between *B. abortus* and cattle suggests that this species may have been the first. In general, swine and goats react more strongly to infection by *B. suis* and *B. melitensis*, respectively, than cattle do to *B. abortus*. There may be further support for the idea that *B. abortus* is the oldest species in the conjectured absence, or at least infrequency, of natural *Brucella* infection among wild animals. It does, however, occur in the American bison, the water buffalo, and the European hare. The docile ox was among the first animals to be domesticated by man; swine, sheep, and goats entered his environment later. The reactions of all animals, including man, that acquire *B. melitensis* or *B. suis* infections speak of the more recent appearance of these two species.

In areas where numerous herds of cattle are infected by *B. abortus*, persons who drink unpasteurized milk are exposed to it. Although the tissues of these persons are invaded, clinical signs and symptoms arise in remarkably fewer persons than the number actually infected. In a rural population exposed to bovine brucellosis through consumption of raw milk, the intradermal skin test using brucellergen may yield a high percentage of positive results but very few clinical cases of brucellosis.

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In addition to the relatively low virulence of *B. abortus*, other factors tend to lessen the danger of drinking milk contaminated with that organism. Infected milk may be diluted with large amounts of uninfected milk at the dairy; but more important, children, the consumers of the largest quantities of milk, are naturally resistant to clinical illness after exposure to *Brucella*. These conditions account for the fact that most human brucellosis due to *B. abortus* results from direct contact with farm animals or their carcasses, but they do not minimize the necessity for pasteurization.

The organisms usually enter through intact skin or mucous membrane. Most of the people who contract clinical cases of brucellosis due to *B. abortus* have handled infected cattle, occasionally infected hogs. Hogs in close association with infected cattle in feed lots may acquire *B. abortus*. Recently sheep in California have also been found to be infected with *B. abortus*.

In some States, such as Iowa, where swine breeding is carried on extensively, swine brucellosis constitutes a threat to human welfare. It may be transmitted to man in two ways: by direct contact with infected hogs or by indirect spread to dairy cattle sharing premises with infected hogs. Under the latter circumstance, the potentialities are worth considering because *B. suis*, in general more pathogenic for man than *B. abortus*, may, in rare instances, reach consumers of raw milk. Usually, however, it is sporadic, appearing in persons who suffer individual exposure by direct contact with single infected animals on the farm or in the slaughterhouse.

Brucellosis in goats is widespread and is the chief source of human brucellosis in Mexico, France, Italy, Spain, Yugoslavia, Turkey, Israel, and Egypt. About 30 years ago the goat was the source of a limited number of cases in southwestern United States. The mortality rate ranges from 4 to 11 percent. *B. melitensis* may infect cattle too, and the situation mentioned with regard to *B. suis* may arise—consumers of raw milk may become infected. In the United States, human infection with *B. melitensis* has recently been traced to hogs. In other countries, for example, in France and recently Germany (5), sheep have

been proved important sources of severe, even fatal, human infections.

The portal of entry of *B. melitensis* is by ingestion, contact, or inhalation of infected dust in the environment of the livestock. Both goats and sheep are the source of dairy products, particularly fresh cheese, and these may be teeming with *Brucella*. If the cheese is sticky, it is likely to remain in the mouth for an appreciable time, thus giving opportunity for the organisms to enter by way of the mucous membrane of the mouth and to bypass the potentially destructive gastric juices. Usually, in human brucellosis of caprine origin, several members of a family are infected simultaneously; in brucellosis of bovine origin, only single cases occur in households.

The soil in goat corrals and stables may be heavily contaminated with *Brucella* that continuously pass in the feces. Being resistant to desiccation, the viable organisms are readily disbursed in the dust stirred up by moving animals. Ingestion of stagnant water from watering places in goat corrals is also a potential source of infection for the goats.

Economic Aspects

Brucellosis, in contrast to many other zoonoses, is responsible not only for widespread illness and misery among human beings, but also for serious economic losses to those who deal in livestock. These losses are of such appalling size in some areas that they are the subject of more concern to many groups than the burdens of disease carried by the people who contract it. In general, the losses consist of (a) decrease in milk supply—an average of 22 percent; (b) loss in offspring because of destruction of fertility—an average of 40 percent—or abortion; and (c) decrease in value of infected cows, goats, sheep, swine, and horses.

According to figures of the National Research Council (6), at least 1,300,000 dairy cows and 800,000 beef cattle in the United States had brucellosis, and the resultant financial loss was estimated at \$100 million. According to a more recent estimate by the Agriculture Research Service, the annual loss has been reduced to \$45 million. The damage caused by *B. abortus* to agriculture in Switzerland during 1 year has

been estimated at between \$3 million and \$25 million. Unfortunately, similar estimates are not available for other countries.

Bovine brucellosis, wherever it occurs, is the cause of very considerable economic loss to the dairyman, with effects probably greater than he generally has realized. Norway has estimated the cost of eradication at less than one year's economic loss due to the disease.

Equally incomplete are the estimates on the losses sustained as the result of brucellosis in goat and sheep raising areas. In southern France, 15 to 40 percent of the flocks or herds are infected; 10 to 40 percent of the infected goats or sheep abort; and thus, annually 100,000 ewes and 50,000 goat kids are lost (7). No one has yet appraised the impact of these losses, in combination with the ravages of disease, on health and well-being in many countries. This negligence is in great part attributable to the lack of recognition by many that this disease is a specific entity because it is so insidious and difficult to diagnose.

Control

In improving the welfare of countries throughout the world, brucellosis must obviously be considered. The World Health Organization and the Food and Agricultural Organization, advised by an expert panel comprised of medical and veterinary experts from all parts of the world, closely collaborating with the International Office of Epizootics and several inter-American congresses, are attacking the problems on a worldwide basis. Human brucellosis can be prevented only if the disease is eliminated from animals. The present goal—complete eradication of bovine brucellosis, rather than adaptation to it—guides the measures taken by these groups.

This is a difficult task, but progress made in the United States, Puerto Rico, and Scandinavian countries (8) gives cause for hope. That infection in cows can be recognized with considerable accuracy by a simple test for agglutinins in their serum was proved nearly 50 years ago. To eradicate bovine brucellosis, early efforts were directed toward destruction of reactors in this test, just as they were in the

campaign against tuberculosis. Regrettably, the test-and-slaughter type of control, when conscientiously followed, is so costly in some parts of the world that it has not been practical to adopt it on a worldwide basis.

Cooperation of the livestock owner cannot depend on legislation alone. An effective educational program, fortified with accurate information, must leave no doubt in the minds of all concerned that living without brucellosis is a desirable necessity.

Efforts to devise an effective, workable, and acceptable control program brought to light several shortcomings in the original planning. Possibly one of the most troublesome is the nature of the agglutination test itself. It has the advantage of being comparatively inexpensive and may be repeated as often as necessary, but it has some disadvantages. For one, the results may be misleading. The serum from some uninfected cows may cause nonspecific agglutination, or early in the infection agglutinins may not be detectable. It has happened that herds considered to be free from the infection on the basis of the test and subsequent slaughter of the reactors later became infected. This disappointing and sometimes disastrous failure occurred usually when the slaughtered animals had been replaced with stock from herds not included in the testing program. Another shortcoming was lack of proper and comprehensive education of all groups concerned and consequently difficulties in the organization of cooperative efforts between livestock owners and livestock sanitary officials.

At a disappointing stage of the control program, progress took a significant and encouraging turn. Through research by Buck (9), Buck and Cotton (10), and Traum (11), a *B. abortus* strain, strain 19, proved effective in preventing abortion in heifers vaccinated when they were 4 to 8 months old. In experimental studies, heifers vaccinated as calves have maintained, during their first gestation, a serviceable protection against brucellosis when exposed by contact with infected cattle. Strain 19, living but attenuated, provides protection, usually without causing disease, because it is of stabilized virulence and produces a low-grade, temporary infection from which the vaccinated ani-

mals recover completely. There is absolutely no transmission from vaccinated to susceptible animals. Abortion has occurred infrequently, and only when the heifer was vaccinated during pregnancy.

The vaccine prepared with strain 19 suspended in saline proved to be a highly perishable product, subject to deterioration by handling under adverse conditions. Many so-called vaccine failures, doubtless due to vaccination with dead or inactive organisms, led to another series of disappointments. Now a process of lyophilization or dehydration of the organisms from the frozen state under vacuum (12) seems to offer more promise. The vaccine so produced, which often unfortunately loses 50 percent of the original viable cells in its preparation, is now the one of choice.

To insure proper supervision of production of the standard vaccine, the California Legislature has empowered the State health department to test biological products and enforce proper transport and storage methods. In California, which has adopted a compulsory vaccination program, and in other States with semicomulsory programs, the overall protection has been remarkably good in most cases. Losses from abortion have been sharply reduced.

The degree of immunity provoked by single or multiple vaccinations has been studied, and in no instance has revaccination enhanced immunity. It is fully recognized that ultimate eradication will be achieved only by using the vaccination of calves as a supplement to blood testing and elimination of the reactors.

Until a thoroughly satisfactory practical field test is devised to distinguish between vaccinal agglutination reactions and reactions due to virulent infection, an animal whose serum reacts at certain levels in this test, whether vaccinated or not, particularly after it attains breeding age, must be considered a dangerous animal. The titer now regarded as positive is 1:200 for vaccinated animals. From the standpoint of the public's health, it is absolutely imperative that these animals, particularly if they are shedding *B. abortus* in milk, be eliminated.

Recent observations on 30 herds, consisting of 2,958 animals in which calfhood vaccination

had been practiced for 5 years, revealed 89 shedders. Only 4 herds were entirely free from infection. Since the percentage of reactors, and in particular of shedders, is low, it is reasonable to postulate that the next step is to identify the shedders by means of a simple method. From the standpoint of the beef herd, it is relevant only to remove the shedders from its midst; from the standpoint of spread of the infection, it is essential to take whatever preventive measures are possible, preferably slaughter.

The application of new methods of culturing milk and cream on special media has the advantage that it furnishes health agencies with valuable information about the progress of an eradication program in milk herds. The methods outlined by Hess and Sackmann (13) or by Goode and his associates (14) should be tried.

The agglutination test was modified to detect *Brucella* agglutinins in milk by Fleischhauer (15); the modified test is called the milk or cream ring test, Abortus-Bang-Ring (ABR), or lacto-agglutination test. Its success depends on a suitable antigen prepared from a heavy suspension of *Brucella* stained with hematoxylin. It is carried out by adding antigen to milk in the proportion of 1 drop per 1 ml. After incubation at 37° C. for 1 hour, the sample is centrifuged and read. Agglutinated stained organisms adhere to the fat globules and rise to the surface; the fat containing the stained organisms causes the layer of milk or cream to be purple.

This test has been used extensively in the United States and in Denmark. Three consecutive negative ring tests on a composite herd sample, 4 to 6 months apart, followed by one negative agglutination test on blood from all animals in the herd, are the criteria for freedom from infection. In Grade A herds the three negative ring tests alone are considered adequate criteria. In the United States a number of States have surveyed milk sheds in co-operation with livestock disease control agencies. This test was proved valuable as a field test, particularly in detecting *Brucella*-positive herds (14).

In an extensive, long-range, thorough study of udder infections, Goode, Amerault, and

Manthei (14) used culture of milk to determine the infection status of vaccinated and unvaccinated herds, and by this means were able to evaluate the shedder status, seroagglutination test, and the relationship of these to vaccination with strain 19.

There is no need to emphasize again that the final determination of the infection status, of either an individual or herd, cannot be made safely on the basis of the ring test or culture of milk alone. These procedures have certain inherent limitations, especially when applied to vaccinated herds, but they are exceedingly valuable when used as supplements to the blood test. When proper use is made of all these procedures, each in its proper place, together with prompt identification and removal or segregation of diseased animals and with application of sound sanitary practice, satisfactory progress towards eradication can be expected to continue.

When undue weight is given to a negative ring test, when blood test reactions shown by vaccinated animals are ignored or unduly discounted, or when seroreactors, untested animals, or seronegative animals from herds of unknown origin are permitted to move in the channel of trade other than to immediate slaughter, progress towards eradication is impeded. It is, of course, wasteful to introduce infection-free animals into infected herds, as experience in Latin America has regrettably shown.

Certainly the interstate regulations pertaining to brucellosis within the United States, as recommended in 1953 (16), might very well be applied to the regulation of importation of cattle into the Latin American countries.

Caprine Brucellosis

Observations made by Dr. G. Renoux, acting director at the Pasteur Institute in Tunis, described by him during a visit in May 1954, may serve to introduce a discussion of control of caprine brucellosis.

A program is being carried out there with the help of grants from FAO and WHO. Susceptible goats, imported into Tunis from Sweden, were artificially infected by the conjunctival route, and the LD₅₀ infective dose for this animal was determined. The mean LD₅₀ infective dose of the most pathogenic strain, *B.*

melitensis 53H38 of Mexican origin, was 20,000 organisms (range: 8,300–48,000). Probably the goats that received small infective doses recovered spontaneously. Mutton breeds of sheep were resistant; the LD₅₀ was 400,000 *B. melitensis* of the same strain. This does not necessarily apply to milking sheep. Age, sex, or pregnancy had no influence on the susceptibility of goats. Kids were susceptible to infection, and some remained infected for many weeks. Subclinically infected goats that acquired the infection as kids doubtlessly play a part in the epidemiology of caprine brucellosis.

With the aid of the inhibiting medium developed by Kuzdas and Morse (17), *B. melitensis* was readily isolated from the feces of heavily infected goats, and from the vagina, quite independent of pregnancy and parturition. Milk of nonparturient goats contained *B. melitensis* as often as did the milk from dams. The centrifuge deposits from the milk, more often than cream, contained *B. melitensis*; evidence of *B. abortus* is more often found in the cream.

The rapid plate or test tube agglutination test remained consistently negative in a number of infected goats excreting *Brucella*. The agglutination titer varied widely from test to test in the same goat. The prozone phenomenon occurred frequently in goat serum. Blocking antibodies appeared to be specific. They were found in more than 90 percent of negative serums from infected goats. The injection of melitine, a skin test antigen prepared from *B. melitensis*, had no apparent influence on the agglutination titer.

The allergic state appeared slowly after infection, and the intradermal tests were strongly positive in heavily infected goats.

Until the tests in Tunis are more complete, recommendations for control rest on former experiences.

Caprine or ovine brucellosis is of tremendous social importance in rural life; this was strikingly illustrated when it was recently introduced into Yugoslavia. It has been effectively eradicated by slaughter of entire herds as soon as the infection is discovered. This public health action is justified because the disease in these animals assumes a chronic form which goes undetected unless special tests are made

and then continues to persist in the newly infected country.

In Latin America, the disease has existed for centuries and is chronic. The problems to be met are these:

1. The diagnostic tests needed to guide the recognition and elimination of infected excreters of *B. melitensis* frequently cannot be made on the scale required, and, if it can, only with great difficulties. The usual agglutination test has limitations. It must be interpreted on a herd basis, not on an individual animal basis. In a personal communication, Renoux wrote that the ring test modified for study of goat's milk appears to be highly specific if the test tubes are incubated for 12 hours at 37° C. Work on this test is also being carried out by Alivisatos and Edipides (18). The test may offer a solution to some of the present diagnostic problems. Twenty years ago, it was pointed out that the intradermal allergy test detects the infected individual goat probably more accurately than the most refined serologic tests (19). Suitable antigens are now available, but the effort required to apply the test is apparently a deterrent factor to its use.

2. Removal of goats with positive reactions to the various tests must be accompanied by strict sanitary herd management, particularly in areas where goats and man live in close association. Those familiar with goat-breeding practices carried out by poor settlers and farmers who own small herds that feed on natural ranges of sandy semidesert and rough and broken terrain fully appreciate the difficulties of accomplishing much in this respect. An educational program—carefully adapted to local needs and skillfully executed until its goals are achieved—is required to familiarize the people with the economic and social consequences of the loss of kids and lambs and the spread of the infection to man. Furthermore, it is never appreciated, and therefore rarely adequately emphasized, that the environment of human habitations where goats infected with *B. melitensis* have been housed for decades is thoroughly impregnated with the infective agent. How to remove the *Brucella* from this contaminated environment is not known, and little effort has been spent in studying the condi-

tions required to accomplish the desired results.

3. Even if all of these requirements could be met and a dependable test-and-slaughter program could be contemplated, the thoughtful health official would still need to look ahead. A primitive people dependent solely on the goat for milk and milk products must receive financial aid from their government because they can meet brucellosis only by replacing stock through importation of clean animals. This is not compatible with the economy of the countries most heavily burdened by caprine brucellosis. Temporary losses will be more than compensated for in the future. Fewer animals will be lost by abortion and productivity will be increased.

The usefulness of calfhood vaccination with strain 19 has already been touched on. This suggests the necessity of further work to find a strain of *B. melitensis* suitable for vaccination of goats and sheep. It seems apparent that no effort should be spared to discover such a vaccine. Meanwhile, one might reflect on some of the problems that lie ahead in this effort. A limited series of tests have shown that goats that have recovered from *B. melitensis* infection have an immunity that rapidly and effectively frees their tissues from the infective agent when they are given relatively large doses of virulent *B. melitensis*. They are not immune to infection with *B. abortus*. Thus, acquired immunity in goats is a proved biological state.

Little present evidence encourages the hope that a killed vaccine or strain 19 can confer an adequate immunity against the continuous chances of infection prevailing in goat-raising areas. On the other hand, an overwhelming amount of data from France, England, Australia, and the United States leave little doubt that at the moment the only effective immunity against *Brucella* abortion is induced by in vivo proliferation of the vaccinating or infecting agent. It must be concluded for the time being that the in vivo synthesis of immunizing antigens is of superior immunogenicity—either in quality or quantity—to that produced by organisms grown on artificial medium. Finding a *B. melitensis* strain with these properties is a difficult task.

Elberg, in a personal communication, offered the hypothesis that a population of *B. melitensis* which has nutritional requirements not satis-

fied by the normal host could be isolated, and this has been done with *B. abortus* and *B. suis* by Berman at Wisconsin University. By supplying a preformed nutritional factor to the host one could propagate the organism at will until an effective immunity is induced. At this point, withdrawal of the required growth substrate would stop growth of the organism, and the host's normal and actively acquired immunity would clear the host's tissue of the organism.

To this end, Elberg and his associates developed a largely streptomycin-dependent mutant of *B. melitensis*. This mutant protected 50 percent of animals vaccinated with it against fairly heavy challenge—the ID₅₀ (infectious dose) for mice, 10 to 20 percent; for guinea pigs, 5 to 10; for goats, 1; and for monkeys, 5. Challenge consisted of two injections of 10¹⁰ cells administered subcutaneously.

Unfortunately, streptomycin could not reach the intracellularly located organisms and therefore could not stimulate their growth. They were able to multiply threefold to fourfold, using the streptomycin they had accumulated in their cytoplasm during growth on the agar containing streptomycin. The strain was not pathogenic according to gross and microscopic histopathologic criteria.

A more proliferative immunizing agent was then isolated from the drug-dependent population on drug-free medium. This mutant was studied carefully and found not to be drug dependent. It was not pathogenic for goats nor for some other animals, but it was less attenuated than the streptomycin-dependent strains in that it multiplied more profusely in mice and guinea pigs. As a result of this ability to multiply, revertant strain 1, among others, was able, in a dose of 10³ cells, to immunize 70 percent of mice against 220 ID₅₀ and 60 percent of guinea pigs against 35 to 50 ID₅₀. Goats and monkeys have not yet been tested.

The in vivo proliferation of revertant strain 1 is such that it multiplies and persists in the spleen of the vaccinated for 11 weeks before it is cleared from the organs. Challenge is conducted at least 6 weeks after the strain is cleared. It is believed that the actual imprint of the immunity depots is more intense quantitatively, and hypothetically it may be taking place with

antigens only slightly, if at all, produced in vitro.

These observations can be interpreted as follows: A living attenuated *B. melitensis* that persists in the tissues after inoculation for only a limited time and produces a "native" *Brucella* antigen does protect highly susceptible small laboratory animals against a moderately severe infection. Apparently a *B. melitensis* variant may be obtained through adaptation of the organisms in vitro. The protective value of such a variant in active immunization of goats has yet to be determined.

Why has this apparently complicated road of experimentation been chosen? The chance of selecting from a *B. melitensis* population growing on a culture plate, a variant of low pathogenicity and high immunogenicity, is so low and the work entailed so time consuming that forcing the development of an immunogenic strain by gradual adaptation to streptomycin seems more promising. Actual experimentation justified the taking of this road, and the progress being made brings the development of an effective method of immunization against caprine brucellosis much nearer.

Rather unfortunately, only two laboratories—the Brucellosis Center at the Pasteur Institute at Tunis, supported by FAO and in cooperation with WHO, and the department of bacteriology at the University of California, assisted by a small grant from the Public Health Service National Institutes of Health—are devoting their energies to the solution of this problem of such importance to the welfare of populations who can ill afford the constant direct and indirect injuries inflicted by caprine brucellosis.

General Recommendations

1. A control program against brucellosis should be undertaken with full, friendly cooperation of the United States Department of Agriculture, Agriculture Research Service, State and local health departments, and livestock owners.

2. A systematic survey of the extent and distribution of brucellosis in different animals where this is not known should precede formulation of a control program.

3. Well-equipped and adequately staffed central and field laboratories are essential.

4. Control of bovine brucellosis should be undertaken with aids recognized and available.

5. Measures should be taken to insure pasteurization of milk. The importance of pasteurization cannot be overstated; it kills *Brucella*. In areas where cow's milk is adulterated with goat's milk, this procedure must be carefully supervised.

6. Reliance on pasteurization alone, without regard for other routes of transmission, is unwise because most infections in many regions are spread by direct contact with infected animals.

7. Diagnostic reagents must be standardized and supplied by a central laboratory.

8. The manufacture and distribution of vaccine made with *B. abortus* strain 19 must be under constant control, preferably by a State or national health or agricultural agency.

9. The official brucellosis eradication program should, whenever and wherever practical, be supervised by full-time State, preferably public health, veterinarians, cooperating with livestock sanitary officials.

10. Serious consideration should be given to adoption of regulations that permit importation only of official calfhood-vaccinated animals over 30 months of age and under 36 months of age, provided the blood test within 30 days of shipment does not disclose a reaction exceeding incomplete in a dilution of 1:200.

11. A brucellosis center, devoting all its efforts to the development of an effective vaccine against caprine brucellosis, should be established in one of the Latin American countries. A committee of experts studying the immunology of this infection should be invited to serve as advisers.

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